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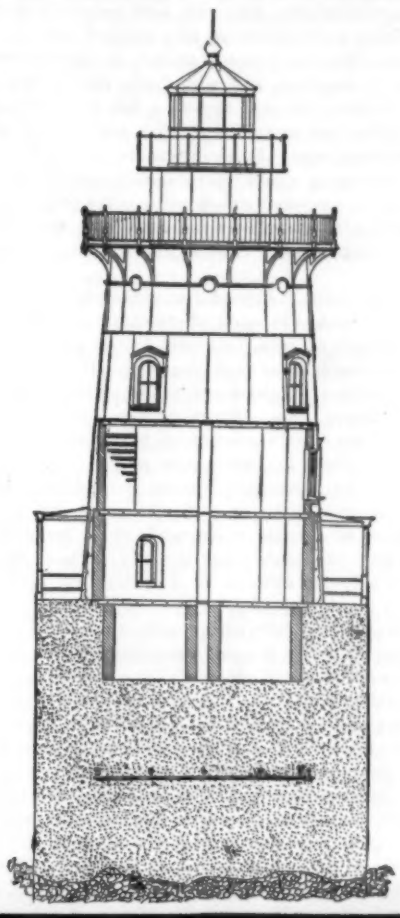
NEW LIGHTHOUSE, HUDSON RIVER.

On the Hudson River, off Kingman's Point, Tarrytown, is a lighthouse recently built by the Government, under the direction of Gen. J. C. Duane, Engineer Third Lighthouse District.

A short distance below the water level a good foundation of gravel was found, upon which was laid a mass of concrete confined by a cylinder of iron, and extending sufficiently high to be above the reach of the greatest tides, and of ample strength to withstand the action of the ice. This is solid, with the exception of the cellar, which is divided into four compartments by walls of masonry radiating from the center.

The tower is circular in section, built of flanged cast iron plates bolted together, and having the thickness of five-eighths of an inch. The diameter of the exterior decreases regularly from the base, which is 22 feet, to the top, which is 18. This portion of the tower is divided into four stories, each 8 feet in height, all of which, except the top one, are lined with masonry, making the interior 18 feet in diameter. The construction is shown plainly in the drawing, the lower half of which is in section, and the upper half in elevation. The floors consist of flanged cast iron plates, of the same thickness as the sides, supported at the center of the tower by an iron column extending through the four stories and to the floor of the cellar, and at the sides by the masonry lining. These plates are set with the flanges up, and upon the latter the wooden flooring is secured. Surrounding the lower story is a gallery whose roof is supported upon iron columns, resting upon the outer edge of the concrete foundation. The watch-room, constituting the fifth story of the structure, is 10 feet 10 inches in diameter, 7 feet in height, and has vertical sides. Around this room is a balcony, having an external diameter of 23 feet, the projecting part being supported by brackets, as shown in the drawing. On top of the watch-room is a fixed light of the fourth order, which can be seen for ten or twelve miles, the height above water being about 50 feet. A railed balcony surrounds the lantern. Within the watch-room is the clockwork, which during foggy weather strikes a bell, placed upon the large balcony, once every two minutes. The weight operating this clockwork descends through the center column of the tower.



Theory of Life.

The late Professor Faraday adopted the theory that the natural age of man is 100 years. The duration of life he believed to be measured by the time of growth. In the camel the union takes place at eight, in the horse at five, in the lion at four, in the dog at two, in the rabbit at one. The natural termination is five removes from these several points.

Man being twenty years in growing lives five times twenty years—that is, 100; the camel is eight years in growing, and lives forty years; and so with other animals. The man who does not die of sickness lives everywhere from 80 to 100 years. The professor divides life into equal halves—growth and decline—and these into infancy, youth, virility, and age. Infancy extends to the twentieth year, youth to the fiftieth, because it is in this period the tissues become firm, virility from fifty to seventy-five, during which the organism remains complete, and at seventy-five old age commences to last a longer or shorter time as the diminution of reserved forces is hastened or retarded.

Court Plaster.

Soak isinglass in a little warm water for seventy-four hours; then evaporate nearly all the water by gentle heat; dissolve the residue in a little dilute alcohol, and strain the whole through a piece of open linen. The strained mass should be a stiff jelly when cold. Now stretch a piece of silk or sarsenet on a wooden frame, and fix it tight with tacks or pack thread. Melt the jelly, and apply it to the silk thinly and evenly with a badger hair brush. A second coating must be applied when the first has dried. When both are dry, apply over the whole surface two or three coatings of balsam of Peru. Plaster thus made is very pliable, and never breaks.

NEW GOVERNMENT LIGHTHOUSE AT TARRYTOWN ON THE HUDSON.

Scientific American.

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NEW YORK, SATURDAY, JANUARY 5, 1884.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 418,

For the Week ending January 5, 1884.

Price 10 cents. For sale by all newsdealers.

CONVERTING IRON ARTICLES INTO STEEL.

Some experiments, which may prove to be a valuable improvement, have recently been made in the manufacture of articles of iron to be afterward cemented or case hardened. The ordinary case hardening as usually applied is too well known to require more than a mention, but the experiments to which allusion is made refer to the production of articles of iron which are usually made direct from steel, especially springs—coiled, spiral, and flat. It is well known that in winding a coiled spring to any desired diameter allowance must be made for the back lash or reflexion of the wire, and the core upon which it is wound must be considerably smaller in diameter than would be the case if the wire when wound and released retained its position in its coils. In these experiments the workman used tough Swedish iron wire, or that made of similar iron adapted for conversion into steel. The iron is as soft as lead, so far as regards the absence of elasticity, and will "stay put" in any coil or crook. It will even coil around a flat bar, making a flat coiled spring, an impossibility with hard drawn brass or tempered steel wire. Every mechanic knows that a flat coiled wire spring would be a pleasant possibility on many a job where now a round coiled spring is the only possibility. But a hard wire wound on a flat bar would, when released, present a Jacob's ladder cross section unfit for any mechanical use.

When the spring is formed it is cemented, or case hardened by being packed in a box or crucible with bone charcoal or ferrocyanide of potassium (prussiate of potash) and subjected to the usual case hardening heat. It is hardened in a bath of animal oil, and drawn to the spring temper by the usual blazing process. Except the wire is of very small diameter only the outside is converted into steel, the core of the wire still retaining its tough iron property. A spring of No. 8 wire, American gauge, when cut, showed merely a skin of case hardening, or steel conversion, but the spring appeared to be as active as one made from the same gauge of steel wire, thus sustaining the views of many mechanics that it is only the exterior of a spring that performs the functions due to elasticity.

If this process of wire spring making proves to be reliable generally, with only as small a proportion of failures as the present method, it will supersede the common way of winding hard drawn iron and brass or tempered steel wire, as the spring may be made from the soft iron wire to exact size and to any required shape, and coiled springs of tested tension and required diameters may be made and kept in stock to be furnished to users as required. If this is possible it will not only create a new industry, but will relieve machine shops from the annoyance of winding wire springs, a department of work that occasions the loss of valuable time and the waste of large amounts of wire. An attempt has been lately made to cut file blanks of soft iron to be afterward converted on their surfaces, and it is possible that this method of converting or case hardening finished articles may be still further extended to advantage, especially when hardness of surface and toughness of interior may be desirably combined.

HEAVY WORK WITH THE DIAMOND DRILL.

We have lately seen samples of cores cut by the diamond drill that are marvelously curious. Sections of rock and ore drawn up from hundreds of feet below the surface showing the stratification and its inclination, with all the varieties of its composition; the veins of ore and its boundaries and dip as well marked and better measured than if the miner was down in the depths of earth sending up his samples; and what is more valuable, the diamond drill sends up the samples partly polished—so smooth is its cut that you have but to wet the core to bring out all the variegated hues of rock and ore. It matters not as to size—one inch to two feet is within the grasp of the modern explorer. Truly we are passing into the diamond age.

DOES NOT WANT TO BE GRAMMARED OUT OF HIS INVENTION.

A correspondent who is a practical worker and an ingenious inventor, but not a man of letters, is at present going through the ordeal of a suit which he has brought against a rich railway corporation for infringement of one of his patents. He complains of the twists and strains in which the lawyers and judges seem to indulge over the wording of the patents, by which means they try to jew the patentee out of his rights, and among other things says: "I think whatever is *new* about a patent belongs to the one who has the patent, whether there is a special claim on it, or its parts, or not; and they can't grammar me out of it; for I think I have not got to put my name on every spear of grass in order to own a meadow, whether I mention the word lot or not in my deed or patent."

Our correspondent's idea is a good one. An inventor ought to be protected in the enjoyment of whatever is new and useful in his patented invention, and ought not to be deprived of the fruits of his labors because a sentence in his specification contains a word too much or too little. Our correspondent's idea is in accordance with the spirit of the Constitution, which provides for the issue of patents for the special purpose of encouraging the progress of the arts and sciences. Liberality, encouragement, and the broadest possible protection of the inventor should therefore be the aim of the courts and of the Patent Office. This the Constitution calls for. But some of the courts and some of the Patent Office officials occasionally seem to take exactly the opposite view, and appear to labor under the notion that it is their duty to discourage, limit, reduce, and nullify as much as possible the constitutional rights of authors and inventors.

ROBERT MACFARLANE.

Robert Macfarlane was born in Rutherglen, near Glasgow, Scotland, April 23, 1815, and died of paralysis in Brooklyn, N. Y., December 21, 1883. His school education was limited to that which was furnished by the parish school of his native town; but he early formed good habits of study, which grew upon him through life.

In 1836, at the age of twenty-one, after having learned the trade of dyer in his father's dye works at Paisley, he sought a new home in the United States, and since that time he has resided in the State of New York. In 1840 he took up his residence in Albany, and soon made his mark among the intellectual and public spirited citizens. Here he was editor of the *Mechanic Mirror*, the organ of a New York State association in the interest of the artisan classes. His able management of this paper led to his appointment, in 1848, as editor of the SCIENTIFIC AMERICAN, and he occupied this position for seventeen years, with the eminent approval of his associates and the patrons of the paper.

In 1865 he was threatened with a failure of eyesight, and felt obliged to suspend writing and study and to seek other employment. He returned to Albany, and there set up a business as dyer and practical chemist; the business was quite successful from the beginning. In 1874 he retired from the active management of the dyeing establishment in favor of his two sons, who have since carried it on and maintained its high reputation. Since 1874 Mr. Macfarlane has resided most of the time in Brooklyn, and free from the cares of business.

He revisited Scotland twice, in 1839 and in 1875. The last visit was described in a series of sketches under the title of "Rambles in Scotland," published in the *Scottish-American Journal*. The sketches were widely read in the United States, and were reproduced in Scotland. Mr. Macfarlane was the author of a History of the Screw Propeller, and was editor of an elaborate Treatise on the Art of Dyeing, both of which were published by John Wiley, of New York. He also has a high repute in Scotland and America as a contributor to literature relating to Scottish antiquities and to the history of Scottish emigration to America. He often used the *nom de plume* Rutherglen.

Mr. Macfarlane was a man of exalted moral character, and his integrity was probably never suspected by any one who was acquainted with him.

Rapid Settlement of the Great West.

The *Financial Chronicle* has an important article on "Government Land Sales," showing the amount of public lands disposed of during the past six years in the several States and Territories, as indicating the direction in which population is moving. The total number of acres disposed of in the year 1883 was 16,830,455. The table of largest sales, in the order of magnitude, is as follows:

	Acres.
Dakota	6,689,505
Nebraska	1,315,104
Minnesota	1,292,909
Kansas	808,655
Washington Territory	763,779
California	704,274
Mississippi	516,511
Oregon	499,770
Louisiana	487,599
Arkansas	460,656
Wisconsin	454,002
Florida	434,749

Texas is not embraced in the list, as the United States have no public lands in that State. The list includes lands sold for cash, and taken under the Homestead and Timber Culture acts. The sales for six years have been as follows:

	Acres.
1878	6,858,781
1879	8,649,259
1880	9,000,495
1881	8,379,518
1882	12,506,202
1883	16,830,455

The increase of sales during the past two years has been very marked, being at the rate of 50 per cent in 1882 over 1881, and 40 per cent in 1883 over 1882. This extraordinary addition to the producing power of the nation, the *Chronicle* argues, must soon tell favorably on the existing business depression, for although the opening of new territory cannot be expected to show full results in the first or even the second year after settlement, "yet when it is remembered that during the two years since the depression set in, more than twenty-nine and a quarter millions of Government acres have been entered upon, it will readily be seen what a wonderful recuperative power this continued opening of new territory offers."

Electric Conductivity of Sulphur.

A professor at one of the French *lycees* has discovered that though sulphur is an insulating material at its ordinary temperature, it becomes a conductor as soon as it is heated. Its conducting power increases with the temperature, and at the fusing point is very considerable. At 320° Fahr., at which point sulphur changes its physical condition and becomes pasty, the conducting power diminishes, but increases again when the substance has attained perfect fluidity. Similar facts have been noticed with regard to phosphorus.

PNEUMATIC PROPULSION OF VESSELS.

The propulsion of vessels by hydraulic reaction has occupied and interested inventive minds more or less for many years. Nor is it at all strange that it should have been so. No one could live by the sea shore, and exercise even very feeble powers of observation upon the movements of marine animals, in vertebrates particularly, and fail to be greatly impressed with the advantages afforded by direct reaction of an ejected current in forcing the animal through the water.

A single illustration is sufficient. Cuttlefish are found on the coasts of most parts of the world. All along our own shores they are abundant during the summer, and are taken in great numbers for bait, being scarcely used for any other purpose. The fishermen call them *squids*. The common species of Long Island Sound is *Loligo pealii*. They often come into the shallow bays and harbors, and when pursued they dart through the water with great swiftness and with a smooth unwavering motion, which it is delightful to watch unless you are bound on their capture, and then it is not so delightful, for the capture is not easy. With a light boat, smooth water, and a strong arm it is very difficult to hold way with them. We speak from experience.

Now this great rate of speed is kept up by "hydraulic reaction." They draw in water by free expansion, and then force it out through a small aperture and are shot ahead (or rather backward, for that is the way they go) as already indicated.

This is the lesson from the squids, and we propose to turn it to account in the propulsion of boats both large and small. But we will use, not hydraulic, but *pneumatic* reaction, and we are brought by it directly into the line which we have been following so repeatedly of late in our plans for storing the wind power. In speaking of wind power for small motors (December 8), we assumed the case of a common row boat to carry a reservoir for compressed air in the form of a pipe laid along the gunwale, the pipe to be of suitable size, say two inches or three inches at choice. This quantity of air we propose to utilize for propulsion, not by driving machinery of any form for the purpose of turning wheels or a screw, but by *direct escape in a jet beneath the boat*. With this jet thrown straight backward the entire reaction from the force of the escaping current must necessarily be expended in driving the boat in the opposite direction, that is, forward, and as action and reaction are always equal, it follows that all the force stored in the compression of the air must be utilized without waste in sending the boat on her course. Theoretically this is true, and cannot be otherwise. But is it true practically? Can it be made to work?

That there are many difficulties in the way is quite manifest. The idea is nothing new, but up to the present time it has never become a matter of actual service. Various patents have been issued for devices to accomplish it, and some of them *seem* as though they ought to succeed, but evidently something is wrong for they have never come into use.

No. 216,140, June 3, 1879, granted to Brewer & Ward, Sacramento, Cal., appears to represent a specially promising plan. No. 133,758, December 10, 1872, to Lorenzo Chase, Portland, Maine, also has much apparent merit. These two are mentioned only to set our inventive friends at work to search the records, and use their own brains in improving upon past unsuccessful efforts, and for the sake of stirring their brains still further we propose to set out here our own plan, making no charge for the advice. We will try to meet and remove one or two of the difficulties.

We have not yet built one of those light draught boats, of August 18, and December 8, but we will take one of them for use at the present time, notwithstanding, in legal phrase *nunc pro tunc*.

We have our reservoir of compressed air at any convenient part of the boat, which has been filled to a proper pressure by the wind wheel. The broad bottom of the boat is provided with two keels, the depth and the distance between the two to be subject to experimental working and change, if needed. In the narrow space between these keels, and so far forward as to be nearly at the anterior edge of the part always submerged, opens a pipe so curved that its line of discharge is directly backward. This pipe is connected with the reservoir and furnished with stopcock and valve. When the stopcock is turned the current of air rushes out with violence in one direction only, that is, straight backward. The action of the current is laterally confined by the keels and above by the bottom of the boat. A free action upon the water is afforded by the constant rush between the keels as the boat is driven ahead.

The position of the jet being far forward, by which the action is allowed its full force before lateral escape is effected, is in the highest degree important, and is one of the points in which it appears to us there has been error in the previous attempts; at the same time the actual buoyant effect of the current of air, placed well forward, is not to be disregarded. In No. 216,140 this jet was placed at the very stern, and it was also set on a swivel so as to be used in steering the boat as well as driving it. This latter effect it seems to us may much more wisely be produced in the common methods.

The plan we thus suggest is of course open to all forms of criticism, but it seems to us to embody the features which are needed. The cost of machinery, the losses from indirect action and from friction, the inconveniences attending both screw and wheel, are all avoided *in theory;* let us see it *in practice*. Patent not applied for. A.

IT is estimated that 7,000,000 envelopes a day are made in the United States.

White Linseed.

The *Monthly Magazine of Pharmacy* draws attention to an exhibit of "white Nugpur linseed," and oil expressed from it, in the Indian section of the Amsterdam Exhibition. This linseed is of a lightish yellow color rather than a white, and the following account is given of it in the catalogue of the Indian exhibits: "Prof. A. H. Church, in a report on a series of experiments on this seed, states that the proportion of oil which it contained was found to be 45 per cent, an extraordinarily high proportion. No record of so large a percentage in any kind of linseed is accessible, the range being from 32 to 43 per cent, and the average about 36. He considers that this oil will be found peculiarly suitable for the purposes of the artist in oil painting, and in grinding with the highest qualities of white house paints, and thus it will secure a ready market and fetch a high price." Commenting on the supply of this linseed and the price likely to be realized for the oil, our contemporary points out that the seed as harvested is not all white, but that it has a large percentage of the ordinary brown seed mixed with it, from which it can be freed only by careful overhauling and picking, which labor must entail an increase in the first value of the seed. By carefully sowing the white seed only, a crop might be raised which would perhaps yield entirely white seed, in which case a profitable variety of linseed would be established.

Improved Cookery of Cheese.

Take one-quarter pound of grated cheese, add it to a gill of milk in which is dissolved as much powdered bicarbonate of potash as will stand upon a threepenny piece; mustard, pepper, etc. Heat this carefully until the cheese is completely dissolved. Then beat up three eggs, yolk and whites together, and add them to this solution of cheese, stirring the whole. Now take a shallow metal or earthenware dish or tray that will bear heating; put a little butter on this and heat the butter till it frizzles. Then pour the mixture into this, and bake or fry it until it is nearly solidified.

A cheaper dish may be made by increasing the proportion of cheese—say six to eight ounces to three eggs, or only one egg to one-quarter pound of cheese for a hard working man with powerful digestion.

The chief difficulty in preparing this dish conveniently is that of obtaining suitable vessels for the final frying or baking, as each portion should be poured into and fried or baked in a separate dish, so that each may, as in Switzerland, have his own *fondu* complete, and eat it from the dish as it comes from the fire. As demand creates supply, our ironmongers, etc., will soon learn to meet this demand if it arises. I am about writing to Messrs. Griffiths & Browett, of Birmingham, large manufacturers of what is technically called "hollow ware," *i. e.*, vessels of all kinds knocked up from a single piece of metal without any soldering, and have little doubt that they will speedily produce suitable *fondu* dishes according to my specification, and supply them to the shopkeepers.

The bicarbonate of potash is an original novelty that will possibly alarm some of my non-chemical readers. I advocate its use for two reasons. First, it effects a better solution of the casein by neutralizing the free lactic acid that inevitably exists in milk supplied to towns, and any free acid that may remain in the cheese. At a farm house, where the milk is just drawn from the cow, it is unnecessary for this purpose, as such new milk is itself slightly alkaline. My second reason is physiological and of greater weight. Salts of potash are necessary constituents of human food. They exist in all kinds of wholesome vegetables and fruits, and in the juices of *fresh* meat, but *they are wanting in cheese*, having, on account of their great solubility, been left behind in the whey.

This absence of potash appears to me to be the one serious objection to the free use of cheese diet. The Swiss peasant escapes the mischief by his abundant salads, which, eaten raw, contain all their potash salts, instead of leaving the greater part in the saucepan, as do cabbages, etc., when cooked in boiling water. In Norway, where salads are scarce, the bonder and his housemen have at times suffered greatly from scurvy, especially in the far North, and would be severely victimized but for special remedies that they use (the mottebeer, cranberry, etc., grown and preserved especially for the purpose; the Laplanders make a broth of scurvy grass and similar herbs). Mr. Lang attributes their recent immunity from scurvy, which was once a sore plague among them, to the introduction of the potato.

Scurvy on board ship results from eating salt meat, the potash of which has escaped by exosmosis into the brine or pickle. The sailor now escapes it by drinking citrate of potash in the form of lime juice, and by alternating salt junk with rations of tinned meats.

I once lived for six days on bread and cheese only, tasting no other food. I had, in company with C. M. Clayton, son of the Senator of Delaware, who negotiated the Clayton-Bulwer Treaty, taken a passage from Malta to Athens in a little schooner, and expecting a three days' journey, we took no other rations than a lump of Cheshire cheese and a supply of bread. Bad weather doubled the expected length of our journey.

We were both young, and proud of our hardihood in bearing privations, were stanch disciples of Diogenes; but on the last day we succumbed, and bartered the remainder of our bread and cheese for some of the boiled horse beans and cabbage broth of the forecastle. The cheese, highly relished at first, had become positively nauseous, and our craving for the vegetable broth was absurd, considering the full view we had of its constituents and of the dirtiness of its cooks.

I attribute this to the lack of potash salts in the cheese and bread. It was similar to the craving for common salt by cattle that lack necessary chlorides in their food. I am satisfied that cheese can never take the place in an economic dietary otherwise justified by its nutritious composition, unless this deficiency of potash is somehow supplied. My device of using it with milk as a solvent supplies it in a simple and natural manner.—*W. M. Williams, in Knowledge.*

A Training School for Head and Hand.

The Chicago Manual Training School has recently been incorporated, the object of its foundation being instruction and practice in the use of tools, with such instruction as may be deemed necessary in mathematics, drawing, and the English branches of a high school course. The Chicago *Industrial World* says that the following course of study is proposed, subject to whatever changes experience may dictate: First year—Arithmetic, algebra, English language, history, physiology, physical geography, free-hand and mechanical drawing. Shopwork: carpentry, wood carving, wood turning, pattern making, proper care and use of tools. Second year—Algebra, plane geometry, physics, mechanics, history, literature, geometrical and mechanical drawing. Shopwork: forging, welding, tempering, soldering, brazing. Third year—Geometry, plane trigonometry, book keeping, literature, political economy, civil government, mechanics, chemistry, machine and architectural drawing. Machine shopwork, such as fitting, turning, drilling, planing, etc. Study of machinery, including the management and care of steam engine and boilers. Latin may be taken instead of English language, literature, and history.

Through the course, one hour per day, or more, will be given to drawing, and not less than two hours per day to shopwork. The remainder of the school day will be devoted to study and recitation. Before graduating, each pupil will be required to construct a machine from drawings and patterns made by himself. A diploma will be given on graduation.

Adulterations in Butter.

When oleomargarine was first brought into public notice there was a good deal of opposition to its introduction, as affording the ready means of deceiving buyers, no matter how much better it might be than poor butter, how entirely harmless, and how thoroughly cleanly were the methods of its manufacture. Laws were therefore passed in several of the States prohibiting its manufacture and sale, only as all the packages should be distinctly branded with the name "oleomargarine." The farmers and dairymen were most anxious for this legislation. But since these laws were passed there has sprung up a large business in what is called "butterine," which usually consists of a little good creamery butter and an admixture of oleomargarine oil and neutral lard. The latter is simply lard with all taste removed, which increases its cost only about a cent a pound; but the butterine thus made is hardly distinguishable by the best judges from a fine creamery butter, under which designation a great deal of it is now coming to market. The winter is the best season for palming off this adulteration, as it does not keep as hard as genuine butter in the warm weather.

A London International Exhibition for 1884.

The Crystal Palace Company, of London, advertise the holding for six months, from April 3 next, of an "exhibition of arts, manufactures, and scientific, agricultural, and industrial products," and invite the participation of American exhibitors. The enterprise is in no way a government affair, but it is suggested that it will afford a valuable opportunity for American manufacturers, etc., to bring their productions before a wider circle of possible customers in the largest and wealthiest city in the world. A court in a central position on the main floor has been set aside for expected American contributions, and the ordinary charge for space is two shillings per square foot, with some exceptions both higher and lower.

Race between a Man and a Horse.

A 100 yard race lately took place at Echo Park, Philadelphia, between a Mustang pony and Frederick Rogers, of Trenton, for a purse of $200. The arrangement was to run fifty yards down the track and return. The track is about fifty feet wide, and Rogers depended on his chances to win by making a shorter turn than the pony. The horse ran down one side of the track and the man the other, each turning in opposite directions. A good start was made, and both man and horse reached the turning point at the same time. In wheeling around the horse became frightened and reared, the rider, in the confusion, dropping his whip. By the time the latter got under way on the home stretch Rogers was some distance ahead, and in the finish won by twenty yards.

The Organ Industry.

Mayor Beatty, of Washington, N. J., says he shipped 1,000 twenty-seven stop instruments during the month of November, this year, against 980 for the same month of last year. Mayor Beatty claims to have the largest organ trade in this country.

Helping Children to Write Compositions.

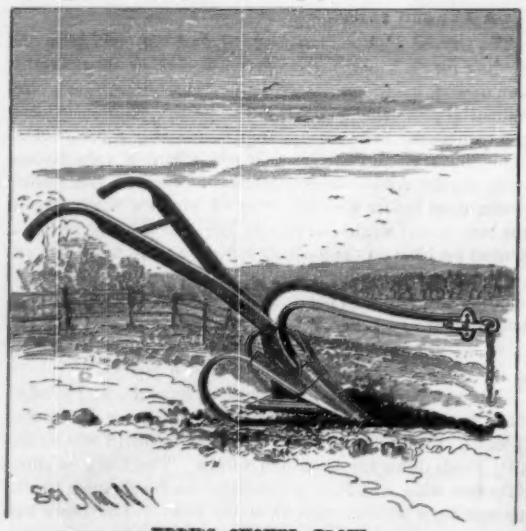
Every *paterfamilias* understands how difficult it is to get children to write their first "compositions." This is, for all ordinary children, the most irksome task of anything which comes up in the routine of school work, and every sort of device and makeshift is resorted to for evading the duty. What strikes us as a very pretty and ingenious idea for greatly lightening the labor of such work, if not making it an actual pleasure, has lately been made a feature of a New York publication, the *Pupil's Companion*. It consists of the presentation of attractive pictures, amusing or instructive, but such as cannot fail to catch a child's fancy, about which the teacher asks the child to write. Among those presented, one shows a child seated on the grass with a plate of soup in its lap, but the soup is being spilled and the child is crying in dismay because a toad has jumped on the plate; another is of a very pretty aquarium, which, besides its variety of fish, mosses, etc., has a fine show of water lilies and other plants; a third is of a bird's nest in the crotch of an old tree, the baby birds reaching out for the food which the parents are seen bringing to them, but underneath is a sign, put on by the proprietor of a farm house appearing near by, and which reads: "Furnished rooms to let—board, small family, no children." We do not believe most children of from six to twelve would count it a task to "write a story" on such subjects.

Luminous Jewels.

M. Gaston Trouve, the well known electrician of Paris, has lately designed a series of ornaments for ladies' wear consisting of glass, colored and cut to imitate rubies, diamonds, etc., fitted in an envolope, surrounding a small incandescent lamp of low resistance. The light shines through the pieces of glass only, and gives them all the appearance of the stone they are intended to imitate. The lamp is fed from a small battery, which is carried about the person. It is composed of three pairs of zinc carbon plates (two carbons to each zinc), or a larger number according to the current required. These plates dip in a saturated solution of bichromate of potash, which is contained in an ebonite cell with three compartments. The plates are fitted into a cover, which is kept securely down on the top of the cell by two bands of India rubber passed around the whole. Finally, the battery is incased in two sheets of gutta percha, so as to prevent any leakage. A miniature switch is carried in the pocket or elsewhere, within reach, to which the battery and lamp wires are connected. The pressure of a finger on the arm of this switch makes or breaks communication with the lamp. The battery weighs (with six plates) 300 grammes, and will work about thirty minutes with a lamp of from 2 to 3 volts. A larger battery, to work a 4 or 8 volt lamp, weighs 800 grammes.

SHOVEL PLOW.

The invention recently patented by Mr. Walden Eddy, and now being manufactured by W. Eddy & Sons, of Greenwich, New York, relates to winged shovel plows having spring teeth arranged to follow in the wake of the plow, on each side of it, and to work at a lower depth than the point of the plow, for loosening the ground laterally beyond the center of the row in which the plow works and nearer to the growing crop. These teeth are formed of flat bent bars, arranged to project laterally and backwardly in diverging directions from the under side of the mould board, and their rear ends are curved downwardly and bent so as to bring them in proper subsoiling position. The forward



EDDY'S SHOVEL PLOW.

portions of the teeth resting against the under side of the mould board are provided with two slots, one in the rear of the other. These slots are so shaped that the attachment may be widened or contracted, or made to run deeper or shallower at its points. The bolts passing through these slots to secure the spring teeth also hold the shovel point and wings to the mould board. In this way the construction is simplified and the mould board and wings are strengthened by the subsoiling attachment passing under them. By slackening the bolts the attachment may be adjusted as required when the bolts are tightened; or it may be easily removed from the plow when not needed. The engraving plainly shows the construction.

DEVICE FOR FASTENING SAW-CLAMPS, ETC., TO WORK-BENCHES.

In the accompanying engraving is a saw-clamp provided with a stationary jaw attached to the bar, *a*, and a removable jaw attached to the upper end of a lever, *f*, which is pivoted to the upper end of the arm, *d*. The lower end of the lever is bent upward to form a hook, and is engaged by a pin on a lever pivoted to the part, *d*, for locking the jaws closed or open. A block carrying the stud-pins, *e*, is arranged to slide in inclined ways (shown by the dotted lines) of arms of a saw-clamp projecting back over the top of the bench from the bar or frame, *a*, that is to be secured to the side of the bench. The ways are so pitched that the block will descend when drawn forward, and force the stud-pins into the top of the bench. It is moved by an elbow lever, *e*, so pivoted to the frame that down or back pressure on the lever will shift the block forward and engage the pins. The lever also

FASTENING SAW CLAMPS, ETC., TO WORK BENCHES.

serves to keep the block in place after being secured by swinging the pivot-joint, by which the rod, *b*, is connected to or below the line of the pivot attaching the lever to the arm, *d*. The bar, *a*, is also formed with stud-pins, *g*, which are at the same time forced into the side of the bench. This makes a simple and efficient device for connecting a saw-clamp to the bench, and it may be readily disconnected by raising the lever to thrust out the stud-pins. Vises and other tools may be as easily connected to the corners of work benches.

This invention has been patented by Mr. Augustus B. Coburn, of 1006 East 5th Street, Kansas City, Missouri.

Two Systems of Water Proofing.

They who have watched the growth of the textile industries for the last half century must have observed the gradually increasing demand for water proof fabrics. At first this demand manifested itself in the ready sale of coarse oiled goods for sailors' "dreadnaughts." Then in the elegant rubber lined material for the hunters' and the travelers' "Macintosh." Afterward in the cheap poncho, blanket, and overcoat, also rubber lined, and now in the "gossamer" for either sex. With hoods and without, as long, loose sacques, or as "Garricks," the number of them sold is greater than that of any other kind of outer garment. Generally worn as they are by throngs of pedestrians in rainy weather, they give as somber an appearance to our streets at the time as would be given by a series of processions of monks and nuns.

Unpleasant as the garments may be in the eyes of spectators, they are probably more so to the feelings of wearers. Impregnated with caoutchouc, gutta-percha, or drying oils, so as completely to close its pores, the fabric entirely arrests the vapors and gases arising from and accompanying the perspiration. Garments made of it are, when worn all day, not only disagreeable to the wearer, but unhealthful, and both on the ground of comfort and of personal hygiene the demand has arisen for a method of water proofing which shall not resist the passage of gases and vapors.

At first sight the invention of such a method would seem to be impracticable, but a little reflection recalled to the minds of manufacturers that there are many substances which water will not wet; which repel it when they are brought in contact with it. Such bodies, in scientific language, are said to be destitute of capillarity.

Familiar examples of this property are sometimes seen in several species of insects which dart over the surface of the still water of springs and brooks. Their feet, which are not moistened, are the centers of little circular depressions of the liquid surface, and seem to repel the water. In this case they exercise on the liquid, and receive in turn by reaction, a repulsive force, the extent of which is measured by the weight of the amount of liquid required to fill the depressions. In other words, the weight of the insect is exactly equal to the sum of the weights of the water required to fill the depressions produced by its feet.

Now if we immerse a tissue in a solution composed of

Gelatine	5 parts.
Soap	5 parts.
Alum	7 parts.
Water	170 parts.

we shall find, upon lifting and thoroughly drying the cloth, that we have communicated to the surface of each particular filament of which the stuff is composed the property of exercising on water a repulsive force similar to that of the feet of the insects above mentioned. Consequently, if upon the surface of the stuff water be thrown, it will not penetrate between the threads, it will be repelled; it will run over without passing through. The texture of the stuff has not been changed by the immersion in the aluminous bath, and gases and vapors can traverse it as before.

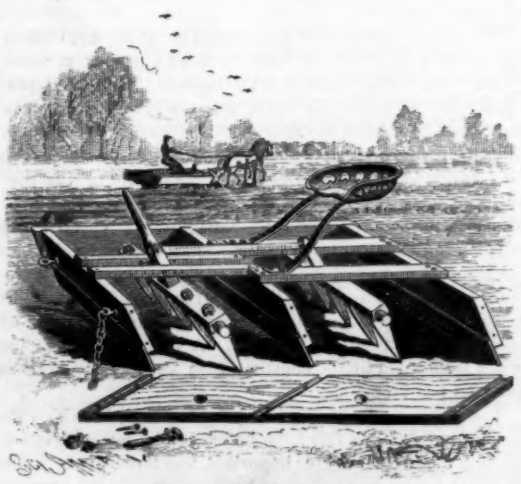
But the impermeability to water is not absolute. Theory and practice both show that under pressure, which varies with the nature of the tissue, it will allow water to penetrate. As water never collects upon our vestments in sufficient quantity to exert an appreciable pressure, little inconvenience is to be apprehended from this property. The new system of water-proofing based upon the principle of capillarity, although far from perfect, promises in time to prove a formidable competitor to the system now in general use. —*The Textile Record.*

Prosperity and Disaster.

According to an exchange, the failing of the Comstock mines brings hopeless ruin upon Virginia City. This place and Gold Hill, which is practically a part of the same town, had 35,000 inhabitants eight years ago; merchants with $1,000,000 capital, a score or more men worth from $300,000 to $30,000 000 each, private homes that cost $100,000, and hotels and everything else to match. Now there are but 5,000 inhabitants, nearly all miners and gamblers; the fine houses are all carried away or abandoned; real estate cannot be sold for the amount of the taxes; nothing can be sold which is not worth carrying away; and in a little time the gorgeous city must entirely disappear. There have been $285,000,000 worth of gold and silver taken from the Comstock mines, and this within a distance of half a mile.

FIELD DRAG.

The side boards of the machine are of any desired length, breadth, and thickness, and their forward ends are beveled upon the lower side and their rear ends upon the upper side. Inclined grooves are formed near their ends and at their centers, as shown in the detached side board in the engraving. Fitted in these grooves are cross boards, held by bolts passing through the side board and into nuts embedded near the ends of the cross boards. To the lower part of the forward sides of the cross boards are fastened steel plates projecting a little below the edge of the board to act upon the soil. Between the grooves in the side boards are holes to receive the journals formed upon the ends of cross bars, to which are attached, by suitable means, the shanks of steel knives, the rear set of knives being arranged to travel midway between the cuts made by the forward set. Levers are attached to the cross bars, the forward lever being longer than the rear one. To the upper end of the short lever is pivoted one end of a connecting rod, the other end of which is pivoted to the middle part of the long lever, so that the two sets of knives can be adjusted to work at any desired depth in the ground and can be raised above the ground. The knives may be held in place by a chain attached to the long lever and hooked upon a pin fastened to the cross board



HILL'S FIELD DRAG.

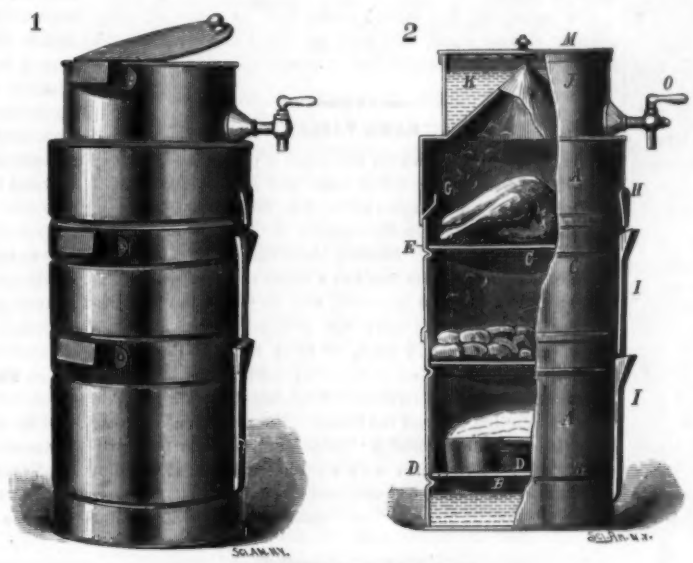
in the rear of the lever. Or the long lever may pass between two parallel bars having holes in which a pin is inserted as shown in the engraving. To the forward cross board or to the forward ends of the side boards are eyebolts to receive the draught. The driver's seat may be arranged as shown. When the machine is drawn over the ground the forward scraper partially levels the soil so that the forward set of knives cuts it into pieces; the center scraper further packs and levels it, and the other knives cut it into smaller pieces, while the rear scraper leaves it in good condition for the planter or seed drill.

This invention has been patented by Mr. Daniel Hill, of New Vienna, Ohio.

COOKING STEAMER.

The accompanying engravings represent a cooking steamer constructed with vessels having inwardly projecting beads near the upper and lower ends, to form flanges to support the partitions, upon which are placed the substances to be cooked. The lower partition, D, has a number of perforations formed through it to allow the steam generated in the lower part of the vessel to pass freely into the space above the partition. The next partition is made without perforations, so that steam can only enter the next space by raising the partition and passing up around its edges, the partition thus serving as a valve and causing the cooking to be done with steam under a slight compression. The lower edge of the cover fits snugly around the upper edge of the top vessel, and has a conical section as shown in Fig. 2. A flange, G, is secured to the inner surface of the cover at a little distance from the lower edge of the sides, forming a trough to receive the condensed water, and also serving as a shoulder to rest upon the upper edge of the vessel, and support the cover.

In a hole in the side of the cover at a little distance from its lower edge, is a siphon, H, the short arm of which extends nearly to the bottom of the trough, and its long arm extends downward at the outside of the cover, so as to discharge the outflowing water of condensation into the funnel-shaped upper end of the pipe, I. The lower end of the pipe enters the upper end of a similar pipe whose lower end is connected with an aperture in the side of the vessel, A, below the lowest bead, so that the water can flow back into the steam generating chamber. To the conical top of the cover is secured the lower edge of an annular flange, the space within which is divided into two compartments by a vertical partition, to the upper edge of which are hinged the straight edges of two semicircular lids. Each compartment is provided with a wire gauze screen, and within which is a faucet, so that the compartments may be used for making tea and coffee when desired.



COOKING STEAMER.

In the several parts of the steamer are secured plates of glass in order that the operator may see whether the chambers are filled with live or partially condensed steam, so that he can regulate the application of heat. To use the steamer, water to a depth of one or two inches is poured in the lower vessel, when it is placed over an oil stove or other heat producer. While in operation all the steam is confined within the vessel, as are all odors arising from the cooking substances. As none of the condensed steam falls upon the food, it is kept dry, and does not become soggy.

This steamer is now being manufactured by the National Cooking Steamer Company, of Lancaster, N. H., who will furnish further particulars.

A New Electric Railway.

A light railway system, driven by electricity and running at high speeds, has been devised by Mr. F. Hahn Dauchell, C.E., of London, whose object is to effect the rapid transit of letters and parcels by electrical means. The distinguishing feature in its construction is that it has only one rail for the train to run on, instead of two, and that it is balanced by another rail overhead, which at the same time performs the function of conducting the electric current, and also prevents the train from leaving the metals, as it is embraced by side friction pulleys, placed in pairs and connected with the roofs of the carriages. A successful working model has been tried; in it the wad is circular and about 8 feet in diameter, the motor being about 12 inches long, 8 inches high, and deriving its current from an ordinary bichromate battery. This motor, or engine, has a pair of grooved driving wheels of large diameter, and placed in line with each other. The object of this construction is to reduce the friction to a minimum, and thus facilitate the production of high speed. Mr. Dauchell proposes a speed of from 150 to 200 miles per hour, the railway being specially designed for the transit of letters, parcels, and light goods.

THE French Government, with a view to the revival of the somewhat languishing industry of coral fishing on the Algerian coast, has published a decree containing certain prohibitions and regulations on the subject. It forbids in future the use of machinery made of iron or other metal, as being destructive of the reefs, and preventing their reproduction.

The First Gas Burner.

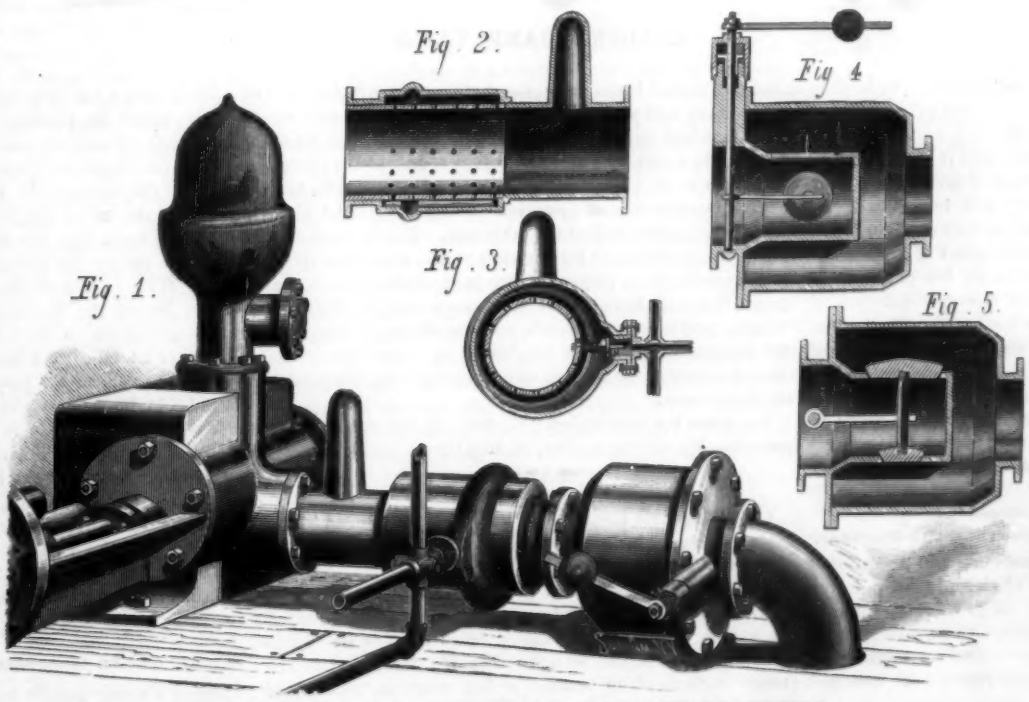
The first gas burner was a very simple and unpretentious contrivance. In one of the earliest works on gas lighting, we read: "The extremities of the pipes have small apertures, out of which the gas issues; and the streams of gas being lighted at those apertures, burn with a clear and steady flame as long as the supply of gas continues." Familiar as it is to us, and from its familiarity unnoticed, the phenomenon presented by the flame thus produced continuing to burn "as long as the supply of gas continued," was doubtless, to the first experimenters, a wonderful sight. Though we may smile at the question, it is not difficult to understand the incredulity of the honorable member who, when Murdock was examined before a Committee of the House of Commons, in 1809, asked the witness: "Do you mean to tell us that it will be possible to have a light *without a wick?*" "Yes; I do indeed," replied Murdock. "Ah, my friend," replied the member, "you are trying to prove too much."

REGULATOR AND CONDENSER FOR STEAM PUMPS.

The accompanying engraving represents a device for regulating the supply of water required to condense a certain quantity of steam, so that the quantity of water supplied will always be in proportion to the quantity of steam to be condensed; and also a device for condensing the exhaust steam from any steam pump or engine, so as to relieve the piston of back pressure. The regulator consists of a short pipe closed on top and provided with a flange for coupling it to a suction pipe. A short distance above this flange is a larger flange, on which a large vessel, surrounding the pipe, is bolted. The top of this vessel is provided with a neck having a flange to which the condenser or suction pipe can be attached, so that the device will be interposed in the length of the suction pipe. Fig. 4 is a horizontal and Fig. 5 a vertical section through the regulator. The small pipe is provided with two opposite ports, one of which is larger than the other, in which fit valves connected by a rod having a slot in its middle, through which an arm passes, as shown in Fig. 5. The arm is attached to one end of a shaft which is journaled transversely in the bottom of the pipe, and passed through a tube provided with a stuffing box. The outer end of the shaft has an arm (Fig. 4) on which is an adjustable balancing weight which seats the valves. The position of the weight can be adjusted so as to admit a greater or less quantity of water into the injection pipe, according to the amount of steam to be condensed. The apparatus can be placed in any position and can be attached to any injection pipe. It can be adjusted to maintain a high vacuum in the pump at all times.

In the suction condenser, shown in longitudinal section in Fig. 2 and cross section in Fig. 3, the suction pipe of a steam pump is provided with a series of perforations, and the perforated portion is surrounded by a pipe forming a jacket. The inclosing pipe is furnished with an eccentric channel (Fig. 2) for conducting the exhaust steam into the space between the two pipes; the depth of the channel gradually decreases from the entrance port for the steam to a point diametrically opposite, as indicated in Fig. 3. At the widest part of this channel is a neck containing a bushing, forming the seat for a puppet valve, mounted on a stem guided in an aperture in the suction pipe in a cross piece in the neck. The steam is conducted to the neck by the exhaust steam pipe, which is provided with a three-way cock, to permit adjusting the exhaust steam pipe for exhausting in the air. The condenser is provided with a vacuum chamber, to prevent pounding in the suction pipe. A spiral spring around the stem closes the valve automatically. When in operation, the steam is exhausted into the air until the water rises in the suction pipe to the perforated portion, when the steam issues in jets through the perforations into the water and is instantly condensed. The spring closes the valve after each exhaust of the pump, thus preventing the water from the suction pipe from rushing into the steam cylinder of the pump. The condenser is simple, and occupies but a small space. The steam from a steam engine can also be conducted to it, if desirable.

The large engraving shows the pump cylinder of a steam pump, to which is attached the condenser, from which leads the regulator to the suction pipe. These devices are now being manufactured by Messrs. Fink & Angevine, of Mount Riga, New York, who should be addressed for further information and catalogue.



REGULATOR AND CONDENSER FOR STEAM PUMPS.

A Process for Softening Iron Castings.

A revolution in the manufactured iron trade is announced from Melbourne, where two local iron founders (Messrs. Jenkins and Law) are reported to have discovered a new process in their trade. It appears that an accidental discovery was the commencement of the invention; a fragment of cast iron having been dropped while hot into a water channel, and afterward broken, when it was observed to be soft and tenacious, instead of hard and brittle as might have been expected. This phenomenon led to inquiry and experiments, with a view to ascertain the reason for the change. It was supposed that the temperature of the metal and the composition of the water were the principal circumstances which combined to produce the transformation; and, after numerous trials, the right temperature to which the iron should be brought before immersion was discovered, and also what foreign elements were required in the water. The metal is merely dipped in the bath, not steeped, the required change being physical, not chemical; and the ingredients of the liquid are common and cheap. As patented, the process is briefly as follows: The castings are run in a chill, or iron mould, allowed to cool, reheated in a furnace to a particular temperature, and then plunged into the bath. Thus treated, the iron develops a close, tough, and comparatively soft grain, so much like that of average steel that, according to the *Melbourne Argus*, experienced founders in the colony had great difficulty in believing the metal to be cast iron at all. By this process it is claimed that the adamantine hardness of chilled castings is removed, and further positive advantages are conferred. This is saved by the great extension of chill castings for purposes to which their hardness formerly rendered them inapplicable. It is contended that the metal is also made much stronger; a bar that would break with a load of 1,200 pounds under the old system being capable, if made in the new way, of withstanding a strain of 1,900 pounds. Lastly, the soft, tough grain produced by the new process increases the facility of working the metal, with a corresponding diminution in the wear and tear of tools, and a finer appearance in the finished article.

The Eighty Ton Gun at Shoeburyness.

The fourth of the series of experiments with the 80 ton gun was carried out at Shoeburyness on November 8, in the presence of the War Office Departmental Committee, and other officers of the Royal Artillery and Royal Engineers. The experiments were previously directed with the view of demonstrating the effect of the fire of the heaviest ordnance against forts of the Spithead type, sections of which were built up on the marshes. On November 8 the test was of a slightly different character, a special target being built up on the range, consisting of a compound slab of iron and steel 5 feet square, the iron being 12 inches thick and the steel 6 inches. Colonel Strangways, R.A., commandant of the School of Gunnery, superintended the operations. The huge gun, mounted on an experimental carriage on a line of rails about 200 yards from the target, was loaded with a charge of 450 pounds of prism No. 1 powder and a Palliser projectile weighing 1,700 pounds. Only one round was fired, but this demonstrated again that the 80 ton gun is still superior to any armor plating that has yet been submitted to its powers. The 18 inches of iron and steel were not only cut clean through, but the target, with its 36 inches of oak backing, was completely smashed up. The experiment appeared to give great satisfaction to the committee, and it is probable that a more exhaustive test will be carried out on a future date.

Transmission of Power by Shafts.

In his recent lectures on "Transmission of Energy," Professor Osborne Reynolds said: "In a revolving shaft, neither the stress nor the velocity is uniform over the section, both varying uniformly from nothing in the middle to their greatest value on the outside; so that their mean product is exactly half the product of the greatest values. The greatest power per square unit of section a shaft can transmit is half the product of the greatest stress into the velocity at the outside of the shaft. Taking, then, the greatest safe working stress of steel at 15,000 pounds on the square inch, taking what is the greatest practical velocity at the surface, 10 feet per second—the speed of railway journals—the work transmitted is 75,000 foot-pounds per second per square inch of section—135 horse power; so that we should have to have a shaft of upward of 7 square inches in section to transmit 1,000 horse power; that is, a shaft of over 3 inch diameter. The friction between such a shaft and lubricated bearings is well known—0·04; so that, calculating the weight of the shaft 24 pounds per foot, we have power spent in friction about 52,000 foot-pounds per mile, that is, one-tenth the total power the shaft will transmit. That is, if we put 1,000 horse power into a 3 inch shaft, making 500 revolutions per minute, we ought, at the end of a mile, to be able to take 900 horse power out of it. If we had to go farther, the size of the shaft might be diminished, so that in the next mile we should again lose a tenth, and if we repeat this process seven times we shall, at the end of seven miles, have left about half the original power put in. It will be thought, perhaps, that a 3 inch shaft is very small to transmit so large a force; this is because the speed of 500 revolutions per minute is inconveniently high for purposes of employing the power; but if it were merely a question of transmission, it would be about the best speed. This, then, shows the limit of the capacity of shafts as transmitters of work."

These two lectures of Prof. Reynolds are full of valuable practical suggestions and information. They are given in full in the SCIENTIFIC AMERICAN SUPPLEMENT 413, and occupy over three pages. All the different forms of transmitting energy are discussed.

To Make Casts Larger or Smaller than the Original.

It is well known that ordinary casts taken in plaster vary somewhat, owing to the shrinkage of the plaster, but it is not possible to regulate this so as to produce any desired change, and yet preserve the proportions. Hoeger, of Gmuend, has recently devised an ingenious method for making copies in any material, either reduced or enlarged, without distortion.

The original is first surrounded with a case or frame of sheet metal or other suitable material, and a negative cast taken with some elastic material, if there are undercuts; the inventor uses agar-agar. The usual negative or mould having been obtained as usual, he prepares a gelatine mass, resembling the hektograph mass, by soaking the gelatine first, then melting it and adding enough of any inorganic powdered substance to give it some stability. This is poured into the mould, which is previously moistened with glycerine to prevent adhesion. When cold, the gelatine cast is taken from the mould and is, of course, the same size as the original.

If the copy is to be reduced, this gelatine cast is put in strong alcohol and left entirely covered with it. It then begins to shrink and contract with the greatest uniformity. When the desired reduction has taken place the cast is removed from its bath. From this reduced copy a cast is taken as usual.

As there is a limit to the shrinkage of the gelatine cast, when a considerable reduction is desired the operation is repeated by making a plaster mould from the reduced copy, and from this a second gelatine cast is taken and likewise immersed in alcohol and shrunk. It is claimed that even when repeated there is no sacrifice of the sharpness of the original.

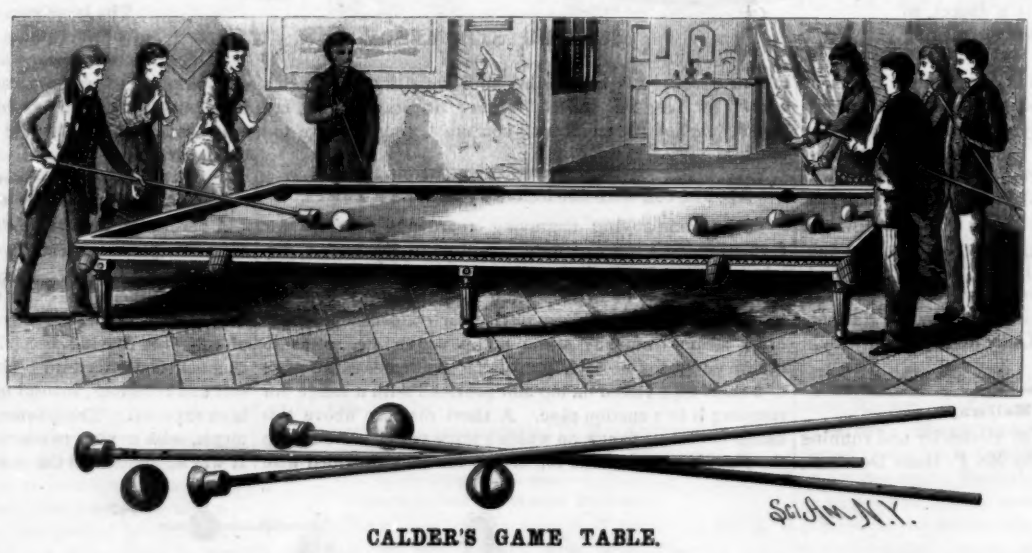
When the copy is to be enlarged instead of reduced, the gelatine cast is put in a cold water bath, instead of alcohol. After it has swollen as much as it will, the plaster mould is made as before.

For enlarging, the mould could also be made of some slightly soluble mass, and then by filling it with water the cavity would grow larger, but it would not give as sharp a copy.

GAME TABLE.

The platform upon which the game is played is 18 inches high, 8 feet wide, and 20 feet long, and is provided with a spring cushion on the sides and a dead cushion on the ends, and also with pockets in the corners, in the ends, and in the sides near the corners. Smaller platforms may be used for private dwellings. The cue has a concave head which fits snugly upon a heavy 6 inch ball, and in which the ball revolves. Eight persons play the liveliest game, although twice this number can play, or even more if desired, at once. The object of the game is to pocket the balls; but the greater number of cushions or carroms that can be made before pocketing the ball the better. Each cushion, carrom, or pocketed ball is termed a "point" and counts five, provided the shot terminates with a pocketed ball. If the shot does not so terminate, carroms and cushions count nothing. All shots must be "called" or "directed." If every point called or directed is not made, the shot becomes a "chance" shot. Every ball pocketed by chance counts one point, or five to that ball, or the side to which it belongs; but when pocketed by a called or directed shot it counts to the player who drove it in. To play the game sides are chosen, and one-half of each side take position at one end of the platform and the other half at the other end. The balls are distinguished by red spots for one club or side and white spots for the other. Each player has two balls, and plays one at a time. When all have played from one end of the platform the total points are registered, and the players at the other end begin to play. At the conclusion of three rounds the totals are compared, and the side or club having the greater are the winners.

The game has been styled "Captus" by the inventor and patentee, Mr. George Calder, of Mill Creek, Utah.



CALDER'S GAME TABLE.

A New Compass.

Capt. Magnagin has invented and lately introduced in the Italian navy a compass which is thus described by the *Jewellers' Circular*:

"Its needle floats upon a pool of water, tinctured with spirits of wine to prevent freezing. The water is contained in a glass vessel, with an elastic vessel to allow its expansion and contraction without breaking the vessel. The needle consists of six bundles of fine magnets, built up of cast ribbon steel, and fixed on a cord. It is inclosed in a hermetically sealed case, which is delicately poised on a brass pivot. The pivot has a sapphire top and a jade point, all highly polished to diminish friction. The advantage of the compass is that the resistance of the water being great to rapid movement is comparatively slight to slow ones, and hence the ordinary movements of the needle are free enough, whereas those due to sudden shocks from without are resisted, with a consequent staying of the indications. Tried on board the Duilio, it is found that the discharge of a 100 ton gun or the motion of the screw does not affect the reading of the compass. The effects of the rolling and pitching of the vessel are guarded against by suspending the floating case a very little above its center of gravity."

How to Clean Stump Lands.

A correspondent of the Ohio *Cultivator* tells how he gets rid of stumps as follows: "Last spring I sent to Indiana and hired a man to come and blast out stumps. I paid 42½ cents per pound for the powder, and 15 cents for each stump taken out, he to furnish caps and fuse. The stumps were mostly white and burr oak, from 20 to 40 inches in diameter, and had been cut from six to twelve years. Sixty-seven of the worst were taken out at an expense of 68 cents per stump. There were only three or four failures in the whole lot. As they were blown into pieces, it was much less work to pile and burn them than when taken out in the ordinary way. I bought material and took out nearly 200 smaller stumps at an expense of about 20 cents each. It took me about ten or fifteen minutes to prepare a blast. I used a 2 inch auger on a 5 foot shaft for boring under the stump. A crow bar will do in soft ground; those who follow the business use a 2½ inch auger. The charge should be put as nearly under the center of the stump as possible. It is not very dangerous to use, as fire will not explode it. The cap is placed in the cartridge and is connected by a fuse. You light the fuse, which in one or two minutes explodes the cap; the concussion of the cap, which is equal to 500 pounds, explodes the dynamite, or Hercules powder. Eight or ten rods is a safe distance if you are facing the stump, for you can easily dodge chunks, if any come toward you. It will not pay to use it very extensively on green stumps, as it will take from three to eight pounds per stump, and will not give very good satisfaction at that."

The Cost of Motive Power from Electrical Accumulators.

MM. Monnier and Guitton have reported to the French Metropolitan Electrical Syndicate upon the use of Faure-Selon-Volckmar secondary batteries as a source of motive power, with special reference to the driving of tramcars. This is a class of work that has occupied the attention of electricians in England and on the Continent, without much success. Accumulators have been designed to supersede gas engines as sources of power for small users; and it has been considered that if tramcars could be economically driven by stored electricity, the way would be made easy for the introduction of the same system into warehouses and town factories. Hence the success or failure of accumulators on tramways has a secondary interest exceeding that of the immediate application. The experiment referred to by MM. Monnier and Guitton took place on September 26, between Paris and Versailles; the motive power being supplied by 100 accumulators, of the 17·5 kilogramme size, coupled in such a manner that the power of 50, 70, 95, or all 100 cells could be applied as required. The car itself weighed 3,500 kilos.; the accumulators weighed 3,200 kilos.; while the passengers weighed only 1,100 kilos. The distance run was 23,900 meters; the rise between the point of departure and the end of the journey being 78·4 meters. The total useful work done was 9·17 hour horse power; and the work given out by the accumulators was 17·6 hour horse power. With regard to the return journey, the falling gradient helped the traction; so that the work done both ways is calculated to be 1.51 times that of the outward journey, or a total of 26·6 hour horse power. In the case of an ordinary tramcar the power required for the day's work would be 74 hour horse power. As the cost of one hour horse power at the works is estimated at 51·7 c., the lowest cost of driving an ordinary car would be 38·25 francs per day, without reckoning the lubrication and maintenance of the dynamo electric motors. The *Revue Industrielle*, commenting on these figures, regards them as too favorable; and considers that the cost should be quite doubled. As expressed by MM. Monnier and Guitton, however, they are by no means favorable to the system.

An Interesting Experiment.

During a recent lecture in the Philadelphia Academy of Pharmacy, glass jars were passed around containing samples of cultivated disease germs. Potatoes cut in halves had been lightly smeared with a coating of substances containing germs. The bacteria were nourished on the moist surface of the potato, and presented very interesting appearances. Different results were obtained from different bacteria. Some of the half potatoes were covered with an ordinary deposit of mould. On others the disease germs had developed into thin, peculiarly shaped patches of fungous growth of bright blue, red, yellow, and greenish colors. Others had grown into an intricate and extensive network of fuzzy fibers, the growth on the surfaces of two or three potatoes reaching over and covering a space having a diameter of eight or nine inches.

Correspondence.

Forest Preservation—Water Flow of the Mohawk.

To the Editor of the Scientific American:

As touching the practical side of the question of the necessity for preserving our Adirondack forests, my recollection of the Mohawk at Cohoes goes back to 1844. Any comparison of the average flow of water now and then in the river bed opposite the great Harmony cotton mills, just below the falls, would be obviously misleading, except it were made for like periods, when the factories were stopped and not drawing water from above the upper dam. It is rather by considering the flow below the lower or State dam, after it has reached its final descent before entering the Hudson, that a good comparison can be made, and the matter is one not only of correct judgment, but calls for such association of facts as will give definite and positive aid to the recollection.

I know positively that during the summers from 1850 to 1853 the North Branch used to afford a pleasant swimming resort for boys of twelve to fifteen, through July and August, in places where now the bowlders are everywhere seen except in times of freshet. My recollection is more clear and positive from the fact that, at that time, though there was enough water to make a clear swim across, against a moderate current, it was by no means pleasant to try and rest a moment by "touching bottom" on the rough bowlders.

The present stream, at the same place, and at a corresponding time of year, would not afford a respectable wading place. I would make a somewhat similar estimate as to the lessened discharge through the South Branch, but have not so clear a fact in mind to aid my recollection.

Very respectfully,

OLD COHOESER.

New York, December 28, 1883.

Movement of the Magnetic Pole.

To the Editor of the Scientific American:

"A. W.," a correspondent in search of scientific truths, asks the following in your issue of November 10, page 298: "What time in years it takes the magnetic pole to make one revolution round its circle, and the radius or diameter of that circle as near as it has been discovered?" I would humbly vouchsafe the following information, trusting it will be received in the same kindly spirit in which it is given: In 1657 the magnetic pole was due north, moving westward until 1816, when its maximum was reached; it is now being steadily diminished, which condition will continue until 1976, when it will again point due north, after a space of 319 years, which is the time required for the magnetic pole to make one revolution round its circle.

J. W. VAN SICKLE, LL.D.

Springfield, Ohio, December 18, 1883.

Storing Wind Power.

To the Editor of the Scientific American:

I have read with interest the articles published in your valuable paper about storing wind power, but I have never heard of any one advancing the idea of applying it to vessels, where, it seems to me, it is most adapted to be used. It is my opinion that a great deal of wind power is lost on board of a ship that could be stored and used in time of a calm. Let *the sail* or *sheets* be *made fast* to a cleat, and have them also made fast to a lever, which lever serves to wind up a spring to be used for running machinery to propel the vessel. That could be done, perhaps, in this way: We all know that wind blows in gusts; connect a reverse spring with the lever, to throw it back when the sheet is slackened by a lull; *then* the lever is in place to wrench up the spring at each gust. Say a vessel should start from New York with a light breeze. The first day that breeze could be used to wind up the springs a little; the next day, say the wind increased, the spring is wound up a little more, and so on until the wind increased to a gale and the springs are wound up to their utmost power. After a gale comes a calm; then the spring would come in play to run an engine to propel the vessel into port. The power now lost on board of ships could certainly be made to wind up a spring, and in the case of a gale of wind a pretty strong one could be used.

Very respectfully,

N. V. TIBBETTS.

Stereoscopic Pictures with a Single Camera.

To the Editor of the Scientific American:

The recent interesting article, "Stereoscopic Portraits by a Single Camera," on page 262 of the SCIENTIFIC AMERICAN, leads me to describe my method for taking stereoscopic landscapes by a single camera, which gives me excellent results. My camera is one of the smallest, just big enough for stereoscopic views; and wishing to use it for that purpose I inserted a slide between the tripod head and the bottom of the camera, upon which the camera can be moved three inches or more in a horizontal line at right angles with the line of sight, while the tripod remains stationary. The slide is a strip of black walnut about three inches longer than the width of the camera, fastened to the top of the tripod head, and grooved at the edges to receive guides of the same material, which are screwed to the bottom of the camera. I expose one plate while the camera is at the left end of the slide, and then press the camera a proper distance to the right and expose the other.

I have never tried this plan for portraits, but I think the only modification required would be, that, in using a lens of short focus, the sitter being so near the instrument, it would be necessary to rotate the camera a little before taking the second picture, in order not to throw the image off the plate by the movement to the right. In field work the greater distance of the object renders this unnecessary.

The advantages of this method over that with double camera are:

1. Two pictures of same size and focus.
2. Field equipment much lighter.
3. Camera and plates less expensive.
4. Horizontal displacement can be varied to give best results according to character of view, distance of object, and power of lens.

The only disadvantage is the liability of animate objects to change position in the interval required to move the camera and reverse the plate holder.

S. F. PHILLIPS.

East Chatham, N. Y., October 31, 1883.

Fast Trains of the Canada Atlantic Railway.

To the Editor of the Scientific American:

Attention has been directed by a friend to an article in your issue of November 10, signed S. Castner, challenging certain statements which have gone the round of the press anent the Canada Atlantic Railway fast trains, and giving a time table on the Pennsylvania Railroad for train leaving Jersey City at 4:08 P.M., reaching Trenton 5:10, making 56 miles in 62 minutes, or 54 miles per hour. If the uncontradicted table of the railway guides be correct, this train arrives at Trenton at 5:12 instead of 5:10, making the run in 1:04, equal to 52·05 miles per hour. A more ingenuous comparison would have given the entire run to Philadelphia, as follows: Leave Jersey City 4:08, arrive Philadelphia 6:00; distance 90 miles, time 1:52, equal to 48·03 miles per hour, with two stops, and would have debited a proportion of the "stop time" to first part of the run.

On the same unfair comparison a better showing is made for the Canada Atlantic than has even been claimed for that road, as follows (see the inclosed time table):

Maxville to Ottawa 43·09 miles, time 50 minutes, equal to 53 miles per hour.

Alexandria to Eastmans 44·04 miles, time 50 minutes, equal to 53·02 miles per hour.

South Indian to Eastmans 11 miles, time 11 minutes, or 60 miles per hour.

The entire run from Coteau to Ottawa, 78·04 miles, with three stops, one of which is for taking water, gives a record of 54½ miles per hour, allowing 6 minutes for the stops.

Perhaps it may interest your correspondent to learn that the official report of this train, for a full calendar month, gives 27 trips in consecutive order, 1:34⅞ minutes average time on a schedule of 1:34.

When it is borne in mind that railway superintendents do not permit of running ahead of time, the regularity of this train's arrival is worthy of note.

MECHANIC.

Ottawa, December 9, 1883.

Effect of Furnace Gases on Iron.

There are exhibited in a museum in Darmstadt, Germany, some samples of round bar iron which have suffered a very peculiar change. These bars of iron were formerly placed within a large chimney at the Frankfort gas works to serve as footholds in case it became necessary to ascend the chimney. For several years they were exposed to various gases at a high temperature, and probably there was among them plenty of carbonic oxide. At last the chimney began to bend and twist, rendering an investigation necessary, when it was found to be due to the increase in size of these bars.

They consisted originally of bars 2·3 centimeters (about 1 inch) in diameter, but have grown to be 3·3 or 3·5 centimeters (1⅜ inch) in diameter. One was examined and found to have within a core 2·1 centimeters thick, surrounded by this external envelope that had been changed and enlarged. The *Gewerbeblatte for the Grand Duchy of Hesse*, from which we gain this information, does not venture any theory as to the probable changes or their causes.

Cleaning Water Pipes.

As is well known, cast iron pipes used for conveying water under pressure generally become incrusted in a longer or shorter time, according to the quality of the water; the deposit consisting for the greater part of oxide of iron and carbonate of lime. A thorough cleansing is of great importance, and three methods, says the *Centralblatt der Bauverwaltung*, have been suggested: 1. Taking out the pipes from time to time, heating them, and scraping out the deposit that is loosened by the heat. 2. Cleaning them with brushes and scrapers before the deposit gets hard. 3. Dissolving the deposit with acid. The second method has been used with great success in Nuremberg and Carlsruhe. A brush that nearly fills the tube is run backward and forward in the pipe while in use, and the muddy slime is washed out immediately by the flow of water. In Carlsruhe the network of pipes is 14 miles long, having diameters of 4 to 13 inches, and they were all cleansed within seventy-eight days in this manner. The expense was £115, or about 1¼d. per yard. For the purpose of introducing the brushes, the pipes are provided with manholes suitable distances apart.

Progress in the Size of Telescopes.

At the end of the 12th century Herschell gave a very great impulse to physical astronomy. His amazing manual dexterity, his activity, his patience, led to the great works which made of him one of the greatest minds that England ever possessed.

Guinand and Fraunhofer led to the realization of large objectives by the progress they instituted in the manufacture of optical glass, while a mechanism of clockwork compelled the glasses and telescopes to follow the diurnal movement of the stars. All modern instruments are mounted in this manner. The tendency is toward enlargement, so that telescopes have reached such a size that some possess mirrors of 1·20 meters in diameter (Paris and Melbourne), with refractors 0·65 meter aperture (Washington), of 0·75 meter and even one meter in diameter.

Is this mania for enlargement justified? Arago, when he asked from the Chamber the credit necessary for the construction of an objective of 0·38 meter, believed that, by raising the enlargement of the glasses to 6,000 times, objects upon the moon 30 meters in length or 2 meters in width should be seen, the causeway of a railroad, fortifications, and monuments. The single difficulty in the way of realizing this hope lies in the deficient luminosity of the images. It is yet impossible to determine to what extent the increase of the optical power of a lens or of a telescope is more than compensated by the increase of special aberration, the difficulty of manipulation, the instability, and deficiency of light.

To give a more exact conception of the fineness of details that are attained in a good instrument, we may recall that Schiaparelli, in his observations upon Mars, made at Milan with a lens of Merz, of 0·218 meter aperture—Mars being distant 14 million leagues during the opposition of 1877—could distinguish a round spot 137 kilometers wide. From Mars an island such as Sicily, a lake of the size of Lake Ladoga or Tshad, could have been seen, a zone of 70 kilometers would have been visible, and Jutland, Cuba, or Panama would have been seen.

The lens of Washington, of 0·65 meter, would show details but one-third the size, that is 44 to 24 kilometers; upon the moon the lowest dimensions would be 315 meters in size, upon the sun 177 kilometers, upon Venus 36 kilometers, upon Jupiter 555 kilometers. Experience proves that the most useful aperture is from 0·38 meter to 0·40 meter.

The following is a table of instruments of which the greatest diameter is 0·92 meter. The number of lenses whose diameter is greater than 0·245 meter does not exceed 63.

Observatory.	Aperture in centimeters.	Builder.
Lick, in Cal.	91·5	A. Clark & Son.
Pulkowa	76·0	A. Clark & Son.
Nice	76·0	Henry Bros., of Paris.
Paris	73·5	Martin, of Paris.
Vienna	68·5	Grubb, Dublin, 1881.
Washington	66·0	Clark, 1873.
McCormick, Chicago	66·0	Clark, 1879.
Newall, Gateshead	65·5	F. Cook & Son, York, 1868.
Princeton, New Jersey	58·5	Clark, 1881.
Strassburg	48·5	Merz, 1879.
Milan	48·5	Merz, 1881.
Dearborn, Chicago	47·0	Clark, 1863.
Van der Zee, Buffalo, N. Y.	46·0	Fitz.
Rochester	40·5	Clark, 1880.
Madison	39·5	Clark, 1879.
Lord Lindsay, Aberdeen	39·5	Grubb, 1875.

—*Revue Scientifique.*

A New Alkaline Developer for Gelatine Plates.

Joshua Smith, of the Chicago Photographic Association, recently explained before that body the advantages which he had discovered in the use of lime water over ammonia in the development of gelatine plates.

He first slakes 1½ ounces of lime by covering it with water over night, in a wide mouthed bottle. He then pours it into a mortar and grinds the lime to a paste, which is next diluted with water and the whole decanted into a two gallon bottle. Any remaining sediment can be ground, diluted, and decanted in the same way. When the whole has been added, the two gallon bottle is filled to two gallons with water, the solution is shaken well and allowed to stand for an hour to settle. It is then filtered and is ready for immediate use. The strength of the solution should now be tested, which is done by first making a solution of water 3½ ounces and acetic acid one-half ounce.

Into 2 ounces of the lime water (in which is placed a piece of blue litmus paper) 1 drachm and 20 minims of the acid solution is poured.

This should just turn the litmus paper red, and will be a standard test. The strength of the lime solution will remain uniform, no matter what the temperature may be—a point of great importance.

The solution will keep any length of time. To prepare the developer, for one or two days' use, take 40 ounces of the filtered lime water and add 1 ounce of an 80 grain solution of bromide of ammonium. To develop, pour into a graduate 6 ounces of the bromo lime water, add a small mustardspoonful of dry pyrogallic acid, shake, and pour over the plate laid ready in the developing tray. The image will soon appear and gain strength. If the plate was overexposed, add a few drops of the bromide ammonium solution and a few grains of pyro.

Very clean, clear, chocolate colored negatives are produced with this developer. Any tendency to fog may be overcome by the addition of a little more bromide of ammonium.

RAILWAY RIVETING MACHINE.

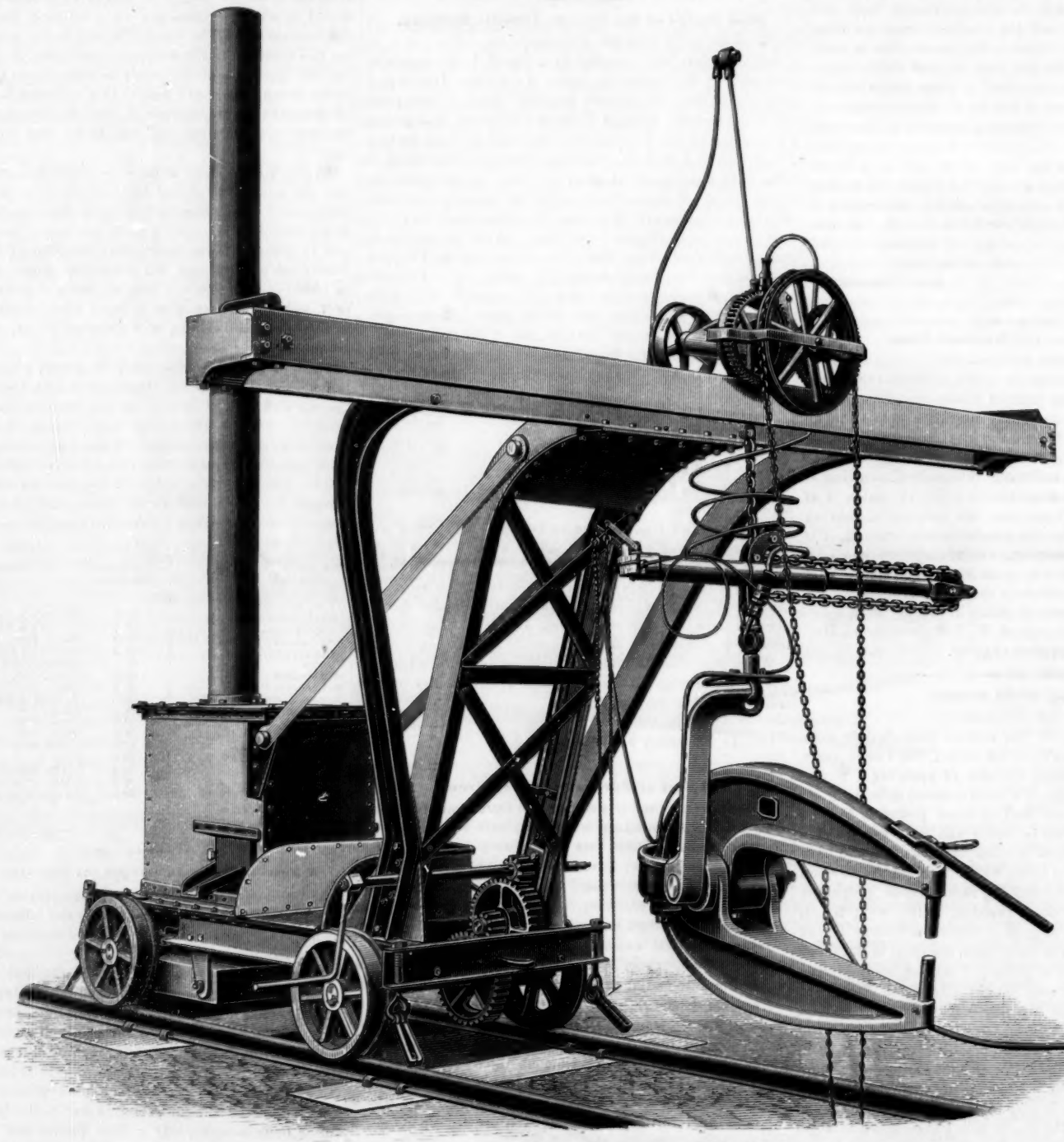
We illustrate a novel arrangement of a portable riveting machine and crane on Mr. Tweddell's well-known system.

The machine in question forms only a part of a very complete traveling plant, designed and manufactured by Messrs. Fielding and Platt, to the order of Mr. Arthur Sullivan, who is at present engaged in the construction and erection of some bridges on the Southern Mahratta Railway. The arrangement consists of a trolly or carriage, upon which is mounted a crane, carrying the riveting machine. By means of a cross gantry the latter is able to be moved in a transverse direction during the time the machine is engaged riveting. The trolly retires as the construction of the bridge progresses; the connection with the pressure main is never interrupted, as the flexible pipes and swivel joints allow for any change of position; a hydraulic chain lift adjusts the position of the machine vertically.

On the same trolly is also mounted a reverberatory rivet-heating furnace, which enables a considerable quantity of rivets to be always ready. The portable riveting machine, which is of the "Fielding" type, and has a gap of 42 in., is capable of closing rivets of 1 in. in diameter.

The riveting machine as shown is in proper position for riveting up the floor-plates of the bridges; it is, however, obvious that the machine can be used with a lever, vertically or horizontally, or at any intermediate angle.

In addition to the crane and riveter illustrated, a motive power trolly is supplied, on which is fixed the steam engine, boiler, accumulator, and pumps. Supplied from this same power trolly are also other travelers carrying spare riveters for different parts of the girders. The object of thus subdividing the plant is of course to minimize as much as possible the load to be carried by the girders during construction.—*Engineering.*



IMPROVED HYDRAULIC RIVETING MACHINERY.

WHILE the eruptions of the volcano Krakatoa and the shocks at Java were proceeding, it was impossible to use the telephones at Singapore, in consequence of the noise in the wires. The sound was like that of a distant waterfall. On one line, part of which was submarine, detonations like pistol shots were heard.

The Invention of the Telegraph.—"Honor to Whom Honor is Due."

That the discoverer of some important truth or scientific principle remains often unknown, and his merits unacknowledged, is Mr. Fahie's reason for contributing to the *Electrician* an account under the heading above, with a chivalrous desire to do justice to the claims of Mr. Edward Davy to priority in the invention of the electro-telegraph.

The subject of this sketch was born in 1806, was educated in London; in 1828 he became a member of the Royal College of Surgeons, and is now living in Australia at the age of seventy-seven.

Mr. Fahie bases these claims upon a number of MSS., which, narrowly escaping destruction by fire as rubbish, were found by the nephew of the inventor, Dr. Henry Davy, of Exeter, who placed them in Mr. Fahie's hands.

In his very interesting narrative, Mr. Fahie writes that the idea of the electro-telegraph first occurred to Davy in 1836, when he sketched out a plan to be worked by statical or frictional electricity; this he soon replaced by the Voltaic current. He considered the Daniell battery, then just invented, or a magneto-electric machine as made by Newman or Clarke, to be the best source of electricity; this was to be set in motion by keys resembling those of a piano, connected to their respective wires. On pressing a key, its wire would dip into a cup of mercury connected with the source of electricity, and thus a communication could be established and broken when the finger ceased to press the key.

Improvements followed, and in 1837 his ideas had assumed a really practical form, his apparatus being so far complete as to submit to the test of actual experiment.

About this time Davy became alarmed by the rumors that Prof. Wheatstone was engaged on an electric telegraph; he at once lodged a *caveat* and deposited an account of his invention with the Society of Arts.

In May, 1837, Cooke and Wheatstone applied for their first patent, to which Davy entered an opposition, lodging at the same time a full description of his apparatus with the Solicitor-General, who decided that the two inventions were different, and allowed the patent to pass; although, according to Davy's account, "time has since shown that they contained some of the clearest identities."

The long pending decision upon Davy's application for a patent was at length given in his favor in July, 1838, Faraday being referred to as the highest electrical authority. Davy now tried to induce various companies to make use of his invention, many of whom almost promised to adopt his system.

Why then did he fail? He had no powerful friends; his father, who might have been of great help to him, thought him a visionary and his plans "*moonshine*;" but it was chiefly because he left England just at the wrong moment. This he himself did not realize, thinking that when the bargain was made, for which the companies were ready and willing, affairs could be managed by an agent or attorney as well as if he were present.

Subsequent events showed how erroneous this idea was, for the directors of the companies wishing to use his invention, having no one who thoroughly understood his instrument, adopted that of Cooke and Wheatstone.

In 1840 Davy's machines were stowed away in an outhouse of Ottery St. Mary, and Mr. Fahie, hoping to find some interesting remains, visited the place, but to his disappointment found that they had all been sold as old iron. In a field near by were found some pieces of cotton-covered iron and copper wire, and six of the Daniell cells—huge things of three or four gallons capacity! Which relics are carefully preserved. And so ends what Mr. Fahie calls "a magnificent failure."

Monument to the Inventor of the Hot Blast.

A monument in memory of Mr. James Beaumont Neilson, of Queenshill, inventor of the hot blast, has been erected on Barstobrick Hill, Queenshill estate, near Kirkcudbright, by his son, Colonel W. Montgomerie Neilson. The monument is shaped after the pyramid style, and is built of large blocks of whinstone, with granite corners. Occupying a commanding position, it rises to a height of 55 feet, and at the base is 20 feet square. On the north side is the inscription: "1883. W. M. N. Fecit." On the south side: "Neilson Hot Blast, 1828."

Compressed Air Motive Power.

A company has been formed in Birmingham, Eng., for the distribution of compressed air through pipes under the streets for motive power. Among the advantages claimed are, the facility for starting workshops; the lessened capital required for this purpose; the consequent enhancement of the value of property; and the obvious hygienic advantages from using pure air instead of continuing the pollution of the atmosphere by the emanations from a large number of small factory chimneys. It is also claimed that compressed air can be applied to existing steam engines "without involving any change of plant, or imposing one farthing of expense upon the present users;" while enabling them to dispense with their boilers and all the concomitant smoke, dirt, danger, and cost of attendance. It is promised, that users will have the new power 20 per cent cheaper than the old, after paying the company supplying it a dividend of at least 10 per cent. The engineers of the new scheme have, says the *Journal of Gas Lighting*, inquired into the cost of small steam power in Birmingham; and they make it out to be not less than £10 per horse power per annum. This is the ascertained average rate of cost for from 10 to 30 horse power obtained in the usual manner. Now, in the scheme, as at present proposed, it is intended to provide for the delivering of 5,000 indicated horse power; this being the estimated requirement, obtained by canvassing the area selected. As a matter of fact, the consumption of steam power in the wards which it is proposed to serve with compressed air—Deritend, St. Martin's, and St. Bartholomew—is about 10,000 horse power nominally; half of which is thus estimated to be replaced by air power. This is to be produced at works situated on the Birmingham and Warwick Canal, where, on half the site available, four air compressing engines, driven by compound condensing steam engines, giving a total of 8,400 indicated horse power, are to be erected, supplied with steam from 44 boilers, fitted with improved furnaces and stoking machinery. Before entering the compressing cylinders, the air will be filtered, to deprive it of soot and dust. The air pressure to be delivered has been fixed at 45 pounds effective above the atmosphere (or 59·7 pounds absolute), as being sufficient for the majority of cases, and more economical of production than a higher pressure. The trunk main from the works will be 30 inches in diameter, and throughout the manufacturing quarter the mains will run through every street, the smallest being 4 inches. The total estimated capital outlay of the undertaking, including a liberal allowance for patent rights and expenses, is just under £200,000. The estimated annual expenditure is £31,000, as against an income of £45,000; thus showing a profit of 12 per cent.

The air as stated is to be compressed to 45 pounds, or three atmospheres above the initial or normal atmospheric mean. At this pressure the output from the works will be 247 cubic feet per second, and the extreme length of the district is 6,000 feet. The calculated loss of pressure by friction in the mains is only 3·06 per cent; but to allow for all contingencies 5 per cent is assumed. Then comes the question of leakage, which is estimated at 10 per cent. No data for this figure are offered; and it appears somewhat low when gauged by the experience of gas distribution under very much lower pressures. It must be understood, however, that the distributing plant will be quite new, and very strong; and that air is not so likely to escape as gas. It may therefore be granted that, although the company expect to lose 10 per cent of pressure by friction (or a reduction from 45 pounds to 40·5 pounds per square inch), and 10 per cent in bulk, they will be very fortunate if their losses are kept within these limits.

It should be remembered that for ordinary use the air as delivered to the consumer will be required to be heated before expansion, in order to obtain the maximum of effect and to avoid the cold that would otherwise follow the sudden dilatation. A temperature of 320° Fah. is calculated for this purpose; but as the user's boiler furnace is supposed to be abolished, how is this heat to be obtained in workshops and warehouses where there are no other furnaces? Here, it would seem, is a good opening for a special appliance to be heated by gas—the only certain and regular source of heat for a purpose of this kind. If the compressed air were caused to pass, on its way to the motor, through a cluster of vertical tubes, at the bottom of which a ring burner were placed, the whole being inclosed in a casing, all difficulty on the score of reheating would be met. On the other hand, it is expected that useful work may be found for the compressed air, when allowed to drive an engine and afterward expand, producing intense cold. For keeping provisions in hot weather, or for brewers, etc., a refrigerating effect of this kind would be found very valuable. It is, indeed, estimated by the engineers that, although half of the power supplied may be sold at about 20 per cent under the average cost of small steam power, the great convenience of the compressed air service will bring it into demand for purposes for which steam power is not adapted, and for which a slightly higher rate may be easily obtained.

Stuffed Spiders.

When it comes to a real live, energetic, ugly, vicious, poisonous spider, says the Santa Barbara *Independent*, Southern California can enter prize animals at any fair. The most precious trophies the tourists bear away from this coast are, in all probability, the neat cards decorated with these monsters of the insect world. Every one is familiar with the trap door and nest of this cunning but ugly creation, and of which strange little habitations every adobe ranch is full. So densely populated with these beautifully lined tunnels are some of the sunny, quiet valleys among the foot hills, that close inspection will reveal their almost invisible trap doors hardly a foot apart. Yet, in spite of this, hardly a living animal will be seen. There is a legitimate demand for prepared specimens, both at wholesale and retail. When first brought in they are deprived of what life is left in their bodies by poisonous fumes or other application of poison. After the taxidermist has made sure they are quite dead—a wise precaution—he cuts them open on the under side and, removing the loose matter therefrom, carefully stuffs them with cotton. This stuffing process is quite a delicate operation, and requires no little knack to perform neatly and successfully, without injuring the animal, and bringing it back to its normal shape and size. A humming bird would seem to be about as small an object as could easily be put through this painstaking operation, let alone an insect even of the size of a tarantula. This having been completed, the spider is placed upon a board and properly held in position by pins, one through the body and one in each foot, and set in the sun to dry.

The sale of them in Santa Barbara is carried on both at wholesale and retail, several parties carrying on the business. The retail price is 50 cents apiece, one merchant disposing of many dozen a year in that way. The wholesale operations are confined to supplying the natural history stores of San Francisco, which establishments pay $3 per dozen for well prepared specimens, the supply seeming never to crowd the demand. In spite of their great numbers, few instances occur where people have been bitten by them, the tarantulas generally being more anxious than the other party to get out of the way.

Taming Wild Humming Birds.

A lady residing at San Rafael, one of the many pleasant health resorts of California, has sent to friends in London an account of the taming of two free wild humming birds by her daughter, who, under medical direction, has for some months passed several hours daily reclining on rugs spread on the garden lawn. "E. has a new source of interest," her mother writes. "The humming birds have claimed her companionship and manifested their curiosity by inspecting her, with their little wise heads turned to one side, at a safe distance, watching her movements, evidently wishing to become acquainted. To entice them to a nearer approach, E. plucked a fuchsia, attached it to a branch of a tree over her head, and filled it with sweetened water. The intelligent little creatures soon had their slender bills thrust into the flower, from which they took long draughts. Then E. took honey, thinking they might prefer it, and filled a fresh flower each day. They would sometimes become so impatient as scarcely to wait for her to leave before they were into the sweets, and, finally, while she held a flower in one hand and filled it with drops from a spoon, the now tame little pets would catch the drops as they fell, and dart into the honey cup their silvery, threadlike tongues. E. is delighted, and so fascinated with them that she passes hours each day of her resting time talking to them and watching their quick, lively movements. Although these tiny birds are humming all day among the flowers, two only have monopolized the honey-filled flower, and these are both males, consequently there are constant squabbles as to which shall take possession. They will not permit a wasp or a bee to come near their honey flower, and not only drive them away, but chase them some distance, uttering a shrill note of protest against all intruders." Referring to them again, at the close of the rainless Californian summer, in a letter dated October 26, this lady writes: "We have had threatening clouds for two days and a heavy rainfall to-day. E. has continued her devotion to her little humming birds. Since the change of weather she has tried to coax them to the parlor windows. They appeared to think there must be some mistake, and would hum about the window where she stood with the honey flower and spoonful of honey, or they would sit on a branch and watch every movement, yet not daring to take a sip until to-day, when at her peculiar call, which they always recognize, one ventured repeatedly to take the honey from her hand."

Electric Gas Lighter.

The covered street at Milan, now well known as the Victor Emmanuel Gallery, is roofed with glass, and completed by a large dome, round the interior of which runs a chain of gas lamps. The lighting of these lamps at a considerable elevation used to present some difficulties, and was always a source of risk, until an arrangement was made for doing the work by electricity. A miniature railway has been constructed close to the gas burners, on which runs a little electric locomotive carrying a wick steeped in spirits of wine. When it is desired to light the burners, this wick is set on fire and the locomotive started on its career. It flies round, rapidly kindling the circle, and exciting great interest among the crowds that assemble nightly to witness the performance.

Liquefied Carbonic Acid.

The fact that carbonic acid gas under a pressure of thirty-six atmospheres and at a temperature of 0° C. passes into the liquid state has been known since the earlier days of Faraday's career, but until recently has been turned to little practical account. A few months since, however, some interest was excited by the statement that liquefied carbonic acid was being advantageously used in the manufacture of aerated beverages, and quite recently, at a meeting of the London Section of the Society of Chemical Industry, the apparatus contrived by Dr. Raydt, of Hanover, in conjunction with Messrs. Kunheim, of Berlin, for facilitating the industrial application of Faraday's discovery was explained by Mr. A. Zimmermann. Of course the important part of the problem consisted in providing a vessel capable of holding the acid under the necessary pressure and yet so that it should be available when required. This is effected by constructing a wrought iron cylinder of about ten liters capacity, representing a quantity of liquid acid which is sufficient when liberated from pressure to yield about 4,500 liters of carbonic acid gas of ordinary density. At one end and screwed into the metal of the cylinder is an exactly finished brass screw valve tap, somewhat similar in principle to a high pressure water tap, by which the exit of the gas can be controlled, so that it may pass into the gasometer or other vessel at any rate desired. It was one of these cylinders that was submitted to the inspection of the meeting referred to, and it was stated that each cylinder is certified to withstand a pressure equal to two hundred and fifty atmospheres. In fact, it is claimed that it has been experimentally proved that, with a temperature of 200° C., the enormous pressure of twelve hundred atmospheres can in this way be made applicable.

The brewing industry in Germany has been one of the first to avail itself of the practical advantages resulting from this invention, in using the pressure resulting from the vaporization of the liquid acid for the purpose of raising lager beer from the cask to the place of draught, instead of condensed air pressure, which in some districts is prohibited on account of the usually impure condition of cellar atmosphere. An interesting experiment is also stated to have been made with cloudy beer in an English brewery, when it was shown that instead of keeping the beer in continuous agitation, as was generally expected, the pressure of the liberated gas acted uniformly and steadily on the top of the liquid. In this way, it is affirmed, all the suspended matters, to which the cloudiness was due, were precipitated by mechanical pressure, the hops floated on the top, and bright beer could be drawn from the intervening space. It is also anticipated that the invention will be utilized by engineers in various way. Already in Kiel harbor a stone, weighing about fifteen tons, has been raised from a depth of thirty-five feet by attaching to it a vessel inflated from one of the cylinders. At Essen, Herr Krupp is said to take advantage of the pressure obtained by the liberation of the gas to condense the molten iron while cooling in the mould. Further, its use for blasting operations and in locomotive engines has been suggested.—*Pharmaceutical Journal.*

Removing Spots from Gilt Frames.

Gilt frames are liable to become spotted and look bad, while it is, as a rule, difficult to remove the spots. Rubbing does not answer, for the stain sticks tighter than the gilding itself, and washing is liable to loosen the gilt if put on with gum or dextrine.

The *Papier Zeitung* recommends the following method of renovating gilt frames. It consists in applying with a camel's hair pencil a gum solution to which has been added gold bronze having the color of the frame. Before mixing with the gum water the bronze must be washed with water until it runs off perfectly clear. If one application does not suffice it may be repeated until the spot entirely disappears, but of course one coat must be dry before the next is applied.

Spots treated in this way look very well at first, but it will not last, for it is not able to resist the moisture in the air unless it is specially prepared. For this purpose an ordinary bristle brush is rubbed with a piece of yellow wax until it is somewhat sticky, then it is passed very lightly over the spot several times as when dusting it. This gives it a very thin coat of wax that hardens in two or three days; in the mean time it must be protected against dust.

Improvement in Developers for Gelatine Plates.

Mr. Henry J. Newton has lately discovered a new solution, which when added to the ordinary carbonate of soda developer increases its developing power fivefold, thereby allowing sensitive plates in the camera to be exposed a much shorter time than is usual.

He makes the following solution: Water, 4 ounces; in which is dissolved bichloride of mercury, 60 grains; into this solution is poured a solution of idodide of potassium, 90 grains; water, 1 ounce. To every two or three ounces of the soda developer he adds from two to three minims of the above solution.

Clear negatives of good tone and quick printing quality are produced. Details in the shadows are brought out with greater facility. It is especially useful in the development of plates which have had an instantaneous exposure. He also found 2 or 3 minims of a solution of 150 grains of iodide of sodium to one ounce of water had a quickening effect, but not so much as the mercury solution.

ENGINEERING INVENTIONS.

A rotary engine has been patented by Mr. John C. Wharton, of Nashville, Tenn. It consists of a cylinder with a vibrating piston pivoted at one side, to swing upon a center of motion apart from the axis of the cylinder; a crank shaft is connected to the vibrating piston to be revolved by its movements, or the shaft may be fixed and the cylinder revolved by the same movement.

An improved car coupling has been patented by Mr. D. P. Kahl, of Lineville, Pa. It is automatic and intended to provide so that the common link will be held in position in one drawhead and properly guided into the other drawhead when two cars come together, without manual assistance, the link pin being held until this is effected, and then released or sprung into its place.

An improved hoisting car for elevating ores out of an inclined shaft has been patented by Mr. L. D. Davis, of Salt Lake City, Utah Ter. Pivoted bars are combined with the ordinary drawbar, and intermediate chains connect said bars to a common cable, the strain being taken alternately as the track is inclined or horizontal, thus adapting the car for convenient use under a variety of circumstances without the need of special adjustment.

A car brake has been patented by Mr. Alfred A. Lambrigger, of Big Horn, Wyoming Ter. A revolving longitudinal shaft on the under side of the car has a pinion engaging with a crown wheel on a vertical shaft, to which the brake chains are fastened, and thus drawn taut when a horizontal shaft or rod is revolved. The rods or shafts have on each end a head and spirally twisted part in which clutch collars are mounted for coupling, so they will revolve together.

An engine lubricator has been patented by Mr. William J. Horn, of Chicago, Ill. It is intended for the cylinders of steam engines, and in combination with an oil reservoir the oiling chamber has a steam vent and two independent plugs above and below. A valve stem is adapted to close the bottom of the reservoir, which screws into a perforated tube arranged therein and has a conical end, so the oil and steam vents may be opened simultaneously.

An ore concentrator has been patented by Messrs. Edward L. Doyle, of Lynn, Mass., and George S. Burr, of Montezuma, Colo., being a new and improved device for washing pulverized ore to separate the metal particles from the gangue, sand, mud, etc. The trough rocks longitudinally and laterally, and its standards may be lengthened or shortened as desired. The flow of water is so arranged that the trough is not likely to be drained, and the matters of the pulp are thoroughly separated and washed. The device is easily arranged to operate on either rich or poor ores.

A balanced slide valve constructed in combination with a shield plate of special form has been patented by Mr. Joshua P. McCook, of Richmond, Va. By this invention it is intended that an engine carrying 120 pounds of steam can be easily reversed at full throttle. The wear on eccentrics, links, rocker boxes, etc., is much reduced, the shield plate supporting the entire pressure on the top of the valve; and the pressure being equal on the sides causes the valve to be very nearly balanced, the preponderance at the lead or crack of the port being in favor of the valve.

An improved method of casting car wheels has been patented by Mr. William Wilmington, of Toledo, O. The present invention is in furtherance of methods for which two former patents have been granted Mr. Wilmington, and is designed to make certain the melting of powdered or granulated ferro-manganese or its equivalents by contact with molten cast iron during the process of casting, and to cause the same to be carried down and diffused in the iron forming the hub and plates, the molten iron forming the tread being at the time in contact with the chill of the mould, and having become so far solidified as not to be subject to the action of the ferro-manganese.

MECHANICAL INVENTIONS.

A sawing machine has been patented by Mr. R. J. Henson, of Cairo, Ill. It has a rock shaft with rigid arm and tilting platform, and vibrating levers connected with the rock shaft arm, the arm being also connected by a bar with the horizontal sliding bar and the vertically sliding frame that carry the saw.

A match sawing machine has been patented by Messrs. Gilford Fiewelling and Gilbert J. Harris, of Hampton, New Brunswick, Canada. It consists of an improved arrangement for holding and shifting the blocks of wood and presenting them to the saws, where they are carried on slowly revolving disks to the grooving or pointing saws, also to the slitting and cutting off saws, in order to improve the efficiency of such machines.

A heel burnisher and edge setter has been patented by Mr. Joseph P. Dion, of Biddeford, Me. The burnishing tool may have a rising and falling motion, also a back motion against a spring when the shoe is pressed upon it. There is a gauge for the bottom of the heel to control the action of the face, and the whole action is designed to be very smooth and easy on the leather, instead of the more positive and harsh contrivances in use.

An improved saw mill feed mechanism has been patented by Mr. George P. Lidy, of Waynesborough, Pa. The paper frictional roller as now used having frequently flat surfaces formed thereon, rendering it irregular and unsteady in action, this invention provides for locating the roller on the saw arbor, in order that its continuous rotation with the arbor shall cause its periphery to be run uniformly when the friction is not great enough to drive the disk.

AGRICULTURAL INVENTIONS.

A corn harvester has been patented by Mr. John Fry, of Mount Jackson, Va. A traveling apron with crossstripe, and rollers with adjustable bearings, and means for driving the rollers, is arranged in combination with a sickle or saw and the reel with a rearwardly-inclined endless belt with projections thereon, and means for running, all forming a novel construction in corn harvesters.

A combined cultivator and planter has been patented by Mr. John W. Pool, of Smithfield, N. C. By a special combination of two cultivators or seed droppers with one pair of shafts the horse is enabled to travel between the two rows, each cultivator running directly over the row, so that twice as much work as usual can be done by one horse. There is a special arrangement for setting the cultivators to be run at such distances apart as may be desired for different widths of field rows.

MISCELLANEOUS INVENTIONS.

A portable door fastener has been patented by Mr. E. F. Pfund, of Sacramento, Cal. It is adapted to be jammed in between the door and the casing and held by a part which is then set against the door, for which the inventor has devised a novel construction.

A hinge for toilet glasses and mirrors has been patented by Mr. C. S. Fleming, of Shelbyville, Ind. It is simple in construction and cheap, but has sufficient tension to hold the mirror at any desired inclination, from the friction of the head in a countersink and the friction of the plate against a washer.

A letter box to attach to the doors of dwellings has been patented by Mr. John H. Carter, of Keokuk, Iowa. The box is cheap, simple, and convenient for the mail carrier, requiring no time to close it, and a bell operated by a spring gives notice when the mail is deposited.

Mr. F. P. D'Opdorp, of Brussels, Belgium, has obtained a patent for an improved article of manufacture consisting in a sheet provided with blank spaces for holding advertisements and holding in the middle letter paper sheets which can be torn off and folded into a letter and mailed.

A boot for horses has been patented by Mr. James O'Brien, of New York city. The invention consists in a novel construction whereby a yielding material is made to form a part of the fastening device, so the circulation will not be impeded, and there will be more freedom of motion in the joint or joints of the leg where it is applied.

A washing machine has been patented by Mr. David S. Hart, of Paradise, Ill. In combination with a covered tank or tub there is a series of pumps with cylinders passing through the cover, and grated and funnel-shaped at the lower ends; the pumps are operated by hand mechanism, and a spring supported rack receives the clothes.

A band shaper for shirts has been patented by Mr. Charles H. Kenyon, of South Glens Falls, N. Y. It is designed more particularly for shaping the neck bands of shirts when ironed, to make them stand up straight and round from the bosom of the shirt; also for shaping other articles, including hat bands and hats, the form of the shaper being varied as required.

A fire escape has been patented by Mr. James H. Downing, of Lane, Kas. This is one of that class of fire escapes in which a frame is suspended from a rope or cable passing over a pulley and extending to the ground. It is small, can be folded compactly, is light, and easily governed, so that it may be made to descend rapidly or slowly as desired.

A fire escape has been patented by Mr. John M. Cunningham, of Flora, Ill. The invention relates to that class of escapes attached to or permanently secured in the upper parts of houses, for lowering from the windows to the ground outside; but by special contrivances it is made to operate so the descent of a person will be automatically governed to a safe speed.

An apparatus for extinguishing fires in oil tanks has been patented by Messrs. George and F. H. Dunham, of Olean, N. Y. The invention provides for annihilators for generating non-inflammable gases, a cylinder having a piston operated by such gas, a mechanism operated by the cylinder piston for spreading a cloth over the tank, and a pipe for conducting the gas into the tank.

An automatic sanding box has been patented by Mr. William Corkill, of Pittsfield, Mass. It consists of devices in a small box, to be held up in the hand, for blowing sand in a regular and uniform jet upon freshly painted work, in lieu of the common pepper box device, having a revolving perforated feeding cylinder and fan blower, with spring power apparatus for working.

A hot air furnace has been patented by Mr. Charles B. Boynton, of New York city. By means of a special construction and combination of parts it is intended to promote economy of fuel by retarding the products of combustion in their passage to the chimney until all of the available heat is extracted therefrom, while the draught is facilitated and the furnace is made entirely gas tight.

An improved lock and latch has been patented by Mr. Henry H. Freeman, of Milton, Ontario, Canada. The knob at the outside of the door may be disconnected at will from the bolt throwing tumblers of the lock or latch to prevent opening the door from the outside, so the lock has increased advantages over the ordinary rim lock, and no key hole need be cut, all effected by special devices and combinations.

A self-acting faucet has been patented by Messrs. Anton Prier, Charles Doherty, and P. E. Everett, of Kansas City, Mo. This invention is for an improvement on a former patent, and by specially disposed cams and levers, the valve stem being guided by a cap, increased facility of operation is given, and, the stem being constantly in contact with the valve seat, hammering and rattling are prevented.

A tricycle has been patented by Mr. Heinrich Sachs, of Washington, D. C. The invention is designed to increase the power and speed of that class of machines in which the seat is made movable, and is connected with the crank axle in such a manner as to co-operate with the foot treadles in imparting a rotary motion to the axle, and for this purpose some novel features of construction and arrangement are proposed.

A chicken coop has been patented by Mr. E. L. Nash, of Parkersburg, W. Va. A wooden frame is bound together by corner bolts, has a board bottom and wire slats but so the bottom may be removed when the coop rests on the ground without the chickens escaping, or the bottom may be so put back with the chickens in, and they will hop on without being injured.

A bee hive has been patented by Mr. Alexander Fraley, of Grayson, Ky., the object being to improve the construction of a hive formerly patented by the same inventor. When the lower section or brood chamber is to be used for two colonies it is divided by a gauze frame, so that should one colony be weaker it may receive heat from the stronger; there is also a special ventilating device, and a contrivance to prevent moths and other insects from entering.

A vehicle spring has been patented by Mr. Patrick G. Clancy, of Lexington, Miss. It is styled "arco equilibrating," and is a particular construction and arrangement of a pair of semi-elliptical spring bars coupled at their middle by a spring, and at their ends supported on end springs above the axle, the whole having a peculiar coactive effect in preventing the side and forward and back movement, but securing a perpendicular rebound.

An improved dental plugger has been patented by Mr. Benjamin F. Eshelman, of Harlan, Ia. It is a right angle attachment for dental engines, and may also be used as a hand plugger; by its use a reverse motion is prevented from being transmitted to the plunger or bit holder and spring of the device, but the hammer may make a widely varied range of blows—a spring, or live blow, as distinguished from a dead blow, without recoil, etc.

An improved truck has been patented by Mr. R. W. Fisk, of Strong City, Kas. A couple of reversely curved arms have handles at one end and clamping disks at the other, for seizing barrels, boxes, etc., the arms being fitted with locking ratchets and pawls, and one of them having adjustably or removably connected to it a wheeled truck, so barrels may be rolled on their bilge or on the truck, and barrels and boxes may be readily placed on either side or end.

A cartridge extractor for breech loading guns has been patented by Messrs. Peter and Charles G. Tissier, of Selma, Ala. This extractor is withdrawn by a spiral spring immediately after the gun is opened and before closing it, but it forces the cartridge out further than usual, projecting it half an inch, and so providing for its ready removal. It is automatic, and so constructed as to work equally as well after long use as at the beginning.

A window cleaning guard has been patented by Marion R. Jabonef, of New York city. It is to provide against accidents by falling from a window sill or frame in case of one's losing their balance or releasing their hold of the sash. Two uprights are made to form inner and outer legs, and a strap or flexible stretcher is arranged to connect the upper outside legs and a sill board, with which the lower ends of the outer legs are connected.

An improved tumbler washer has been patented by Mr. John T. Whittle, of Baltimore, Md. In ordinary devices where tumblers are placed bottom up over and pressed down upon a rotary support, thus opening valve and allowing the water to play upon the inside, the arrangement is such that the pressure varies a good deal according to the work being done; this invention provides for such construction of a washer as shall avoid interference, and also permit the tumblers to rotate more freely, thus facilitating the cleaning.

A burglar proof safe has been patented by Mr. W. H. Hollar, of York, Pa. The invention consists of an improved construction for better resisting attacks by means of wedges driven in at the edges of the door. The bars that carry the locking bolt are interlocked with the inner plate of the safe door by means of flanges, of dove tail or other form, so that the resistance to breakage is taken from the fastening bolt and transferred to the bar and inner plate of the door. The safe door also has interlocking ribs to resist the action of wedges in forcing the door outward from its seat.

A spike extractor for pulling nails and spikes quickly and easily has been patented by Mr. John Ebbert, of Rockaway Beach, N. Y. A pair of quadrantal toothed sectors are so pivoted to each other as to compel the engagement of the curved sectors with each other by mesh of their teeth, one sector having a hook for engaging the spike, and a lever at the opposite end or side of its toothed rim, the lever to be worked to rock its sector on the relatively stationary sector, so that the greatest leverage is obtained when required in starting the spike.

A time shell has been patented by Mr. Thomas J. Armistead, of Lancaster, Pa. This invention relates to shells or projectiles with interior clock work, whereby a firing mechanism may be operated at any desired moment, and provides a new and novel arrangement of parts. The shell is a cylinder holding the explosive, to which is secured a conical point with the timing and firing mechanism, this being affixed by a water tight joint. By a special arrangement the timing and firing mechanisms are firmly held until the desired instant required for the explosion.

Mr. James N. Douglass, of Dulwich, Surrey, England, has obtained a patent for an improved burner for gas or oil. This invention consists in a number of concentric rings adapted to receive either the gas or the wicks in case oil is to be employed. Deflectors are provided for inclining the outer flames into the inner one for the more thorough combustion of the flames. If the intensity of light of the oil burner is to be diminished, the wicks may be lowered in the inner rings and the light extinguished. In decreasing the light of the gas burner the flow of gas is cut off from the inner rings by the usual cocks.

A useful and exceedingly simple crank coupling has been patented by Mr. Ely E. Hyatt, of Salona, Clinton Co., Pa. The crank may be fixed to the end of the driving shaft in the same way as a handle, but is bent outwardly with a right angled twist, and the other end, or that which is to apply the power, has an elongated slot. By this means a churn or other machine having a rotary motion, and provided with a hand crank, can readily be connected with power without pulleys or gearing, and as readily changed back to be worked by hand.

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at the office. Price 10 cents each.

Correspondents sending samples of minerals, etc., for examination, should be careful to distinctly mark or label their specimens so as to avoid error in their indentification.

(1) D. D. L.—If the remedies for removing smoke from mica plates are not effective, try wiping them off with a soft sponge wet with alcohol or vinegar.

(2) C. L. asks for some information of the composition of glass, and if it will stand any weather hot or cold? A. The composition of glass varies according to the quality desired, and for any detailed information recourse must be had to the articles on the subject. These can be obtained in the various cyclopedias and technical dictionaries, Lippincott's, Spons', Ure's, etc. In a general way there are four varieties of glass: 1. The potassium calcium silicate. 2. The sodium calcium silicate. 3. The potassium lead silicate. 4. The aluminum calcium silicate. That it stands heat and cold is evident from our every day use of the article. The power of resisting changes in temperature is always heightened by annealing.

(3) F. E. writes: 1. I find the statement made that whitewashing cast iron will prevent or rather diminish radiation. What then becomes of the heat which was radiated before the surface was white coated? Is it carried through the flue into the outer air, or is it still given off into the room? A. Carried through flues and other outlets. 2. Will it be advisable and economical to whitewash a school room stove? A. No; do not whitewash.

(4) J. L. C.—Paper cannot be made soluble in water. It can be reduced to a pulp or the same condition that it was in before being made into paper. It can be made plastic, as in the celluloid process by macerating with camphor and alcohol. It then becomes transparent under pressure, but does not return to its original consistence by exposure to air. Paper may also be made soluble by immersion in nitro-sulphuric acid, washed, dried, and dissolved in ether. This is the collodion of the druggists.

(5) C. H. D. asks: What is the composition of "regulus metal?" It is used in England for cocks and fittings at ammonia works. What other metal or alloy would best resist corrosion from ammoniacal liquor and be suitable for cocks and fittings? A. Martial regulus is an old English term for an alloy of iron and antimony; probably it may be this alloy that is used for cocks and fittings for ammonia works. We do not know of such being made in this country. Cast iron and steel are in general use in this country for ammonia and in ammonia works. These fittings, valves, and cocks are on sale in New York. Stoneware fittings, which are used to a great extent in England, may also be purchased in this country.

(6) J. B. asks if there is an artificial process of petrifying wood, and explain the process. A. Wood cannot be petrified artificially in the same manner as is done in the natural way, as that is by substitution of silex in place of the wood. Saturation of wood by soluble silica or water glass will make it hard, or it may be covered with a thin coat of mineral matter as is done in some mineral springs. The real petrifactions are the work of ages.

(7) S. asks what is the best sand to use in making steel castings to make the surface smooth, and what is the alloy used called silicide of manganese, and what percentage do they put in steel? A. Crucible steel (cast steel) is cast into iron moulds. Bessemer steel castings are made in silicon or silica sand; ordinary sand will not stand. In converting iron into Bessemer steel, 0·80 of one per cent of manganese is added.

(8) C. A. M. asks: How are the figures and lines made on steel tapes? A. The lines and figures are printed upon the steel ribbons with asphalt varnish instead of ink. The tapes are then put in a bath of acid and etched to the required depth. For the bath use to one gill of acetic acid or good strong vinegar, 20 drops nitric acid. Time, five to ten minutes for light work.

(9) J. M. writes: 1. I inclose a check—what is it made of? A. The check is Welling's compressed ivory, and its composition and mode of manufacture secret. 2. I also inclose a small piece of sheet zinc—what number is it, No. 25 American gauge? A. The zinc is No. 25 American gauge.

(10) H. S. writes: Cigarettes with a paper cover are sometimes tipped at the mouthpiece with a mucilage or gum which prevents the paper from sticking to the lips, and the mucilage or gum does not get dissolved by the moisture of the lip. Will the SCIENTIFIC AMERICAN tell me how to prepare this gum? A. The method followed by one of the largest cigarette manufacturers is dipping the ends into melted paraffine. The process and machinery are secret.

(11) F. W. C. writes: 1. Will you give a simple receipt for curing sheep skins for home use, with and without the wool? Also the way to prepare sheep skins and cattle hides for market? A. If the skins are green, lay the skin flesh side up, and spread equal parts of salt, saltpeter, and alum, pulverized finely; roll the skins closely and let them lie for a few days. Then wash thoroughly and scrape off any flesh that may remain on the skin. Then soak the skins for 24 hours in a weak solution of sal soda, borax, and soap. Then wash in soap suds and soak again in a weak solution of alum and salt, equal parts. Then wash in warm water and dry. Then work the skin to soften by rolling and rubbing. The raw skins of sheep and cattle need only salting and drying for market.

(12) D. N. G. writes: In your edition of June 16, 1883, under the heading of "An Elastic Lacquer," on the 5th and 6th lines you say, "55 pounds of *melted India rubber* are added." Please be kind enough to tell me if raw India rubber is meant, and how to melt it. Is it done with naphtha, as described in SUPPLEMENT, No. 158? A. Crude commercial rubber is the article referred to in the issue you mention. It is melted by heat; we would recommend that it be melted over a water or steam bath in order to prevent the burning. It can be dissolved in naphtha, and the evaporating of the latter will leave the rubber in suitable condition for use in the manufacture of a cement.

(13) S. M. R. writes: Can material be had or made for colored light other than the offensive kind commonly in use—something suitable for Christmas service or social use? A. You can use candle lights in colored gelatine lanterns or alcoholic solutions of various colored salts can be prepared, but we fail to comprehend how these are in any way better than the mixtures commonly sold.

(14) J. M. D. asks for a color for paper so that water or alcohol will have no effect on it. A. We know of nothing better than the coating of the paper with some waterproof composition. A transparent copal varnish would answer for this purpose, we believe. It would be best to first waterproof your paper and then coat it with color. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 96, page 1531.

(15) C. E. W. asks what to use in tanning skunk skins, to deodorize them? A. The process of tanning fur skins is given in answer to query 15 in the SCIENTIFIC AMERICAN, Sept. 1, 1883. To deodorize skunk skins hold them over a fire of red cedar boughs, and sprinkle with chloride of lime; or wrap them in green hemlock boughs, when they are to be had, and in twenty-four hours they will be deodorized.

(16) J. M. K.—You can straighten band saws in the following manner: Put the saw on to the machine and under tension, just as it is to be used. Use a steel straight edge 10 or 12 inches in length to find the lumps or twists, which mark with chalk so as to know where to hammer. Now hold the oval face of a millwright's or carpenter's hard wood mallet opposite the chalk marks and against the saw, and with a light, oval faced hand hammer knock out the lumps. Commence carefully, do not strike too hard. Examine your saw often with your straight edge to see how you get along, and you will soon be able to take out twists readily and get your saw perfectly true. J. E. E.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

L. C. L.—Sample No. 1 has the appearance of being a poor fire clay; its value in New York would not exceed $1.50 per ton. Sample No. 2 has no commercial value. Both of these samples might be utilized in local industries, but they would not pay cost of mining and transportation to any distance.

NEW BOOKS AND PUBLICATIONS.

A PLEA FOR THE CURE OF RUPTURE. By Joseph H. Warren, A.M., M.D. James R. Osgood & Co., Boston.

This is only a brief monograph on an important part of the general subject of "hernia," being principally on the pathology of subcutaneous operation by injection, but it comes from a distinguished operator and authority on the subject, and will undoubtedly command wide attention in the profession. Although written especially for doctors, it cannot fail to interest every inteligent reader who may be afflicted with rupture.

GALVANOPLASTIC MANIPULATIONS. William H. Wahl, Ph.D. Illustrated. Henry Carey Baird & Company, Philadelphia. Price, $7.50.

This book is "a practical guide for the gold and silver electroplater and the galvanoplastic operator." It is based upon Roseleur's *Manipulations Hydroplastiques*, but, in addition, it embraces all the more recent and important processes, methods, and formulæ, especially as developed and practiced in the United States. The battery and the dynamo electric machine, in their various types and modifications, are noted in connection with the deposition of all the metals by their aid. The necessary apparatus in the most approved processes of deposition by simple immersion are clearly explained and illustrated. The work is divided into three parts, treating of thin metallic deposits, galvanoplastic operations, proper—thick metallic deposits—and the chemical products and apparatus used. Each branch and detail of the subject are concisely and clearly dwelt upon, no one of any importance being omitted. Either as a guide for the amateur or an aid to the skilled operator, the book will be found of great value.

CHEMISTRY; GENERAL, MEDICAL, AND PHARMACEUTICAL. By John Attfield, F.R.S. Henry C. Lea's Son & Co., Philadelphia, Pa.

This manual is a work on general chemistry, so far as the laws and principles of that science are concerned, but is directed mainly to the pupils, assistants, and principals engaged in medicine and pharmacy. The first few pages are devoted to some of the leading properties of the elements, after which comes a detailed consideration of the elementary and compound radicals, the analytical and synthetical bearings being pointed out. Then are treated the chemistry of substances naturally associated in animals and vegetables, practical toxicology, and the chemical as well as microscopical features of urine. A laboratory guide to the chemical and physical study of quantitative analysis constitutes the concluding section. In the appendix is a table of tests for impurities in medical preparations, and one of the saturating power of acids and alkalies. The book differs from chemical text books in the exclusion of the discussion of compounds which at present only interest the scientific chemist, also in containing the chemistry of every substance recognized in general practice as a remedial agent, and in the paragraphs being so classed that the work may be used as a guide in studying the science experimentally.

CHEMISTRY; INORGANIC AND ORGANIC, WITH EXPERIMENTS. By Charles Loudon Bloxam. Henry C. Lea's Son & Co., Philadelphia, Pa.. 992 illustrations. Leather, $4.75.

After having defined atoms and molecules, and their weights, and enumerated and classified the elements and also divided the compounds into organic and inorganic, the author reaches the first division of the book, treating of the chemistry of the non-metallic elements and their compounds; the second section being taken up with the chemistry of metals, and the remainder of the book with organic chemistry. Throughout the work are introduced simple illustrative experiments, which the student can perform for his own instruction, thus obtaining a clearer insight into the mysteries of the science. English weights and measures and the Fahrenheit thermometric degrees have been used, the various calculations are in the simplest arithmetical form, and technical terms are used only when absolutely necessary. The present edition (fifth) has been carefully revised and brought into harmony with modern views. The author has most admirably succeeded in his design "to give a clear and simple description of the elements and their principal compounds, and of the principles involved in some of the most important branches of manufacture."

GUENN: A WAVE ON THE BRITISH COAST. A novel. By Blanche Willis Howard, author of "Aunt Sevena," "One Summer," etc. James R. Osgood & Co., Boston.

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